

ART METAL

LIGHTING

CREATIONS

*for*

EFFICIENT LIGHT CONTROL



## PIONEERING FOR FINE ILLUMINATION

### *Plus Decorative Appeal*

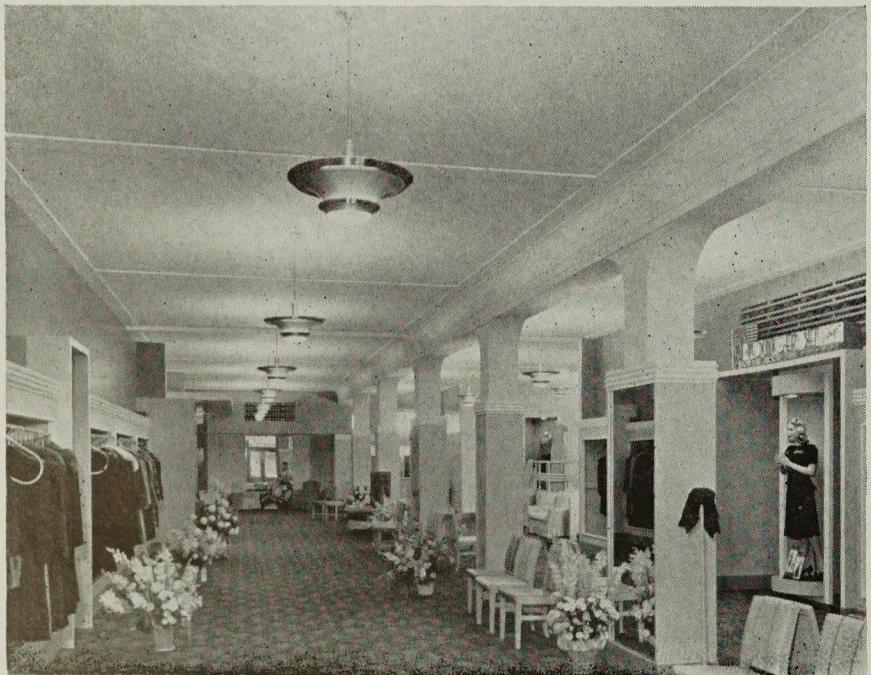
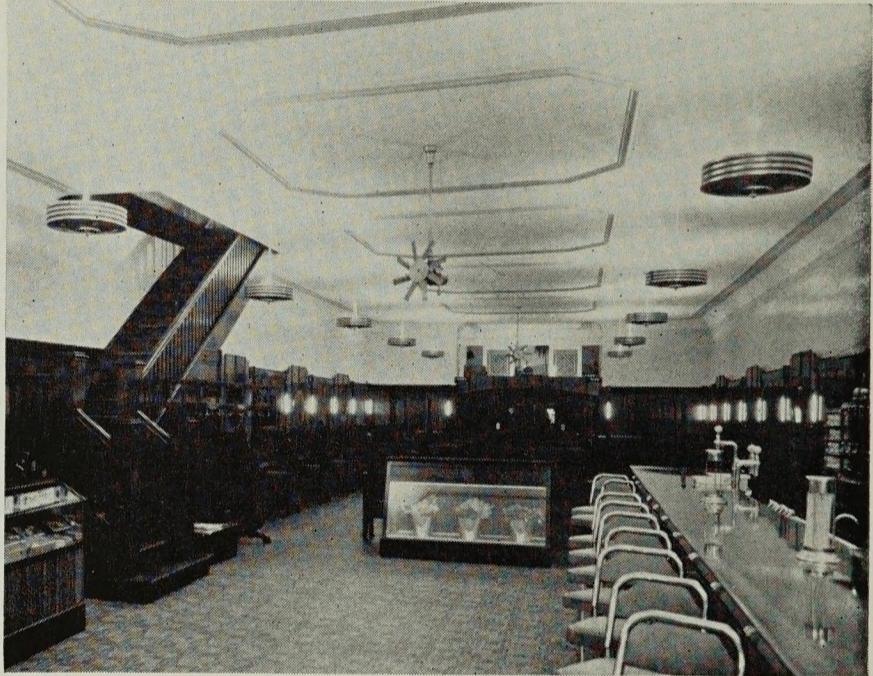
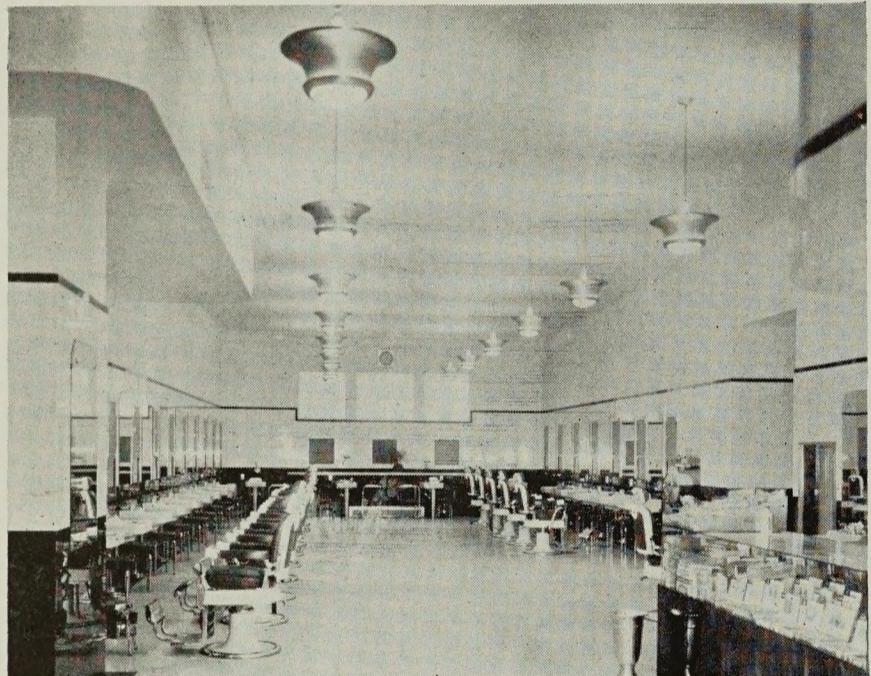
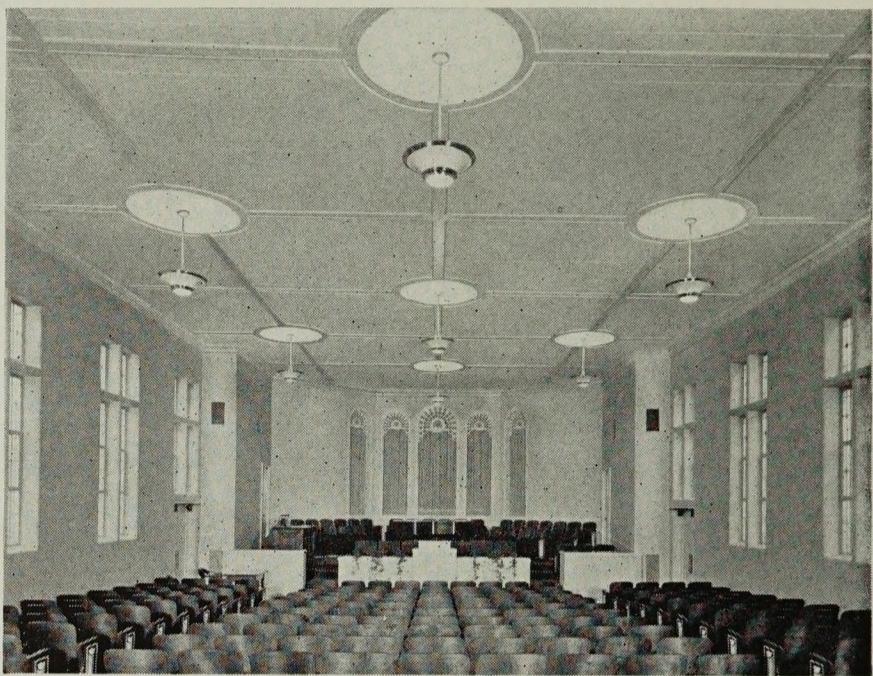
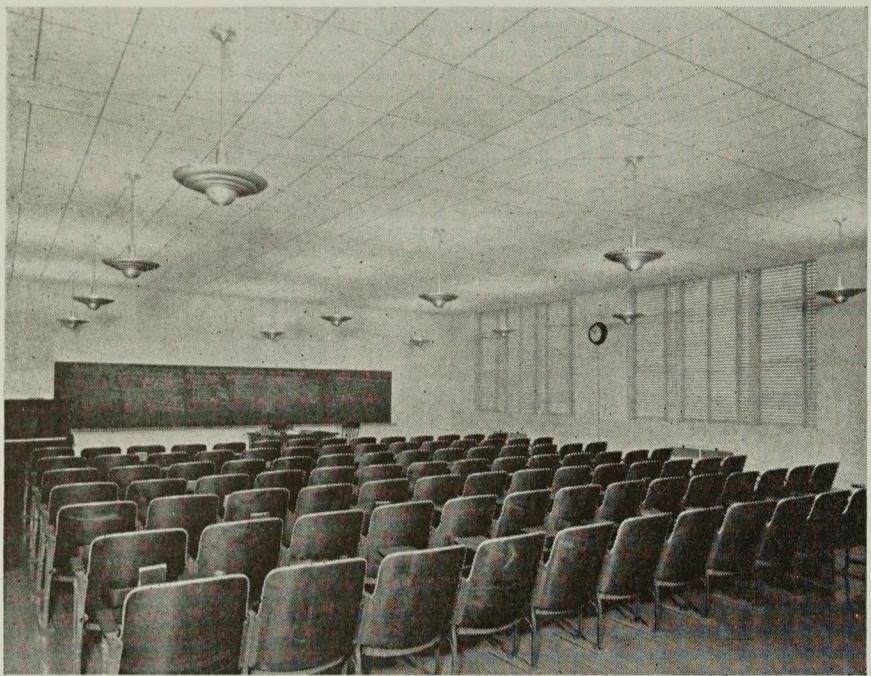
★ It is the constant endeavor of Art Metal to bring to the field of illumination, fine lighting . . . correctly efficient light control and pleasing attractiveness. Always mindful of the need for "Better Light—Better Sight," Art Metal offers you lighting creations that embody the three essentials of good lighting . . . adequate illumination . . . avoidance of glare . . . and avoidance of too great contrasts in light and dark spots, plus simplicity of design and smart styling that make interiors more appealing. Progressive leadership is our belief, our habit, our ideal and it is with pride that we present to you these advanced ideas in fine lighting creations.

**THE ART METAL COMPANY, CLEVELAND, OHIO**

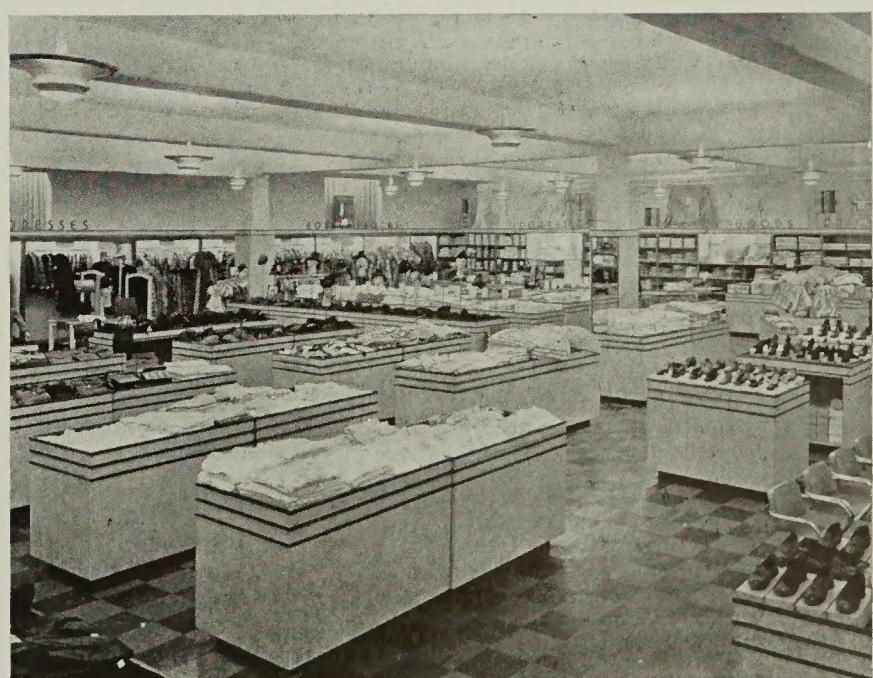
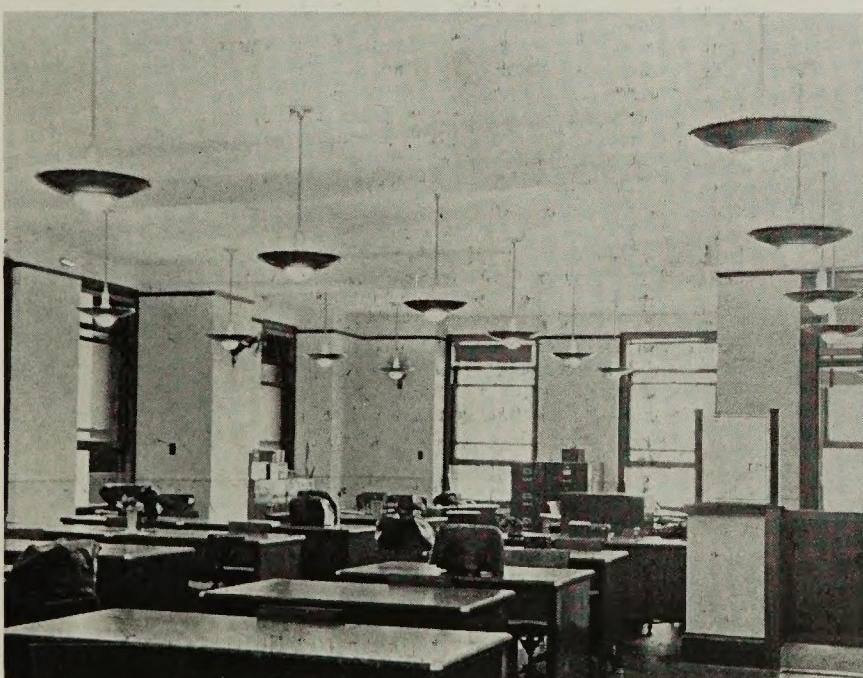
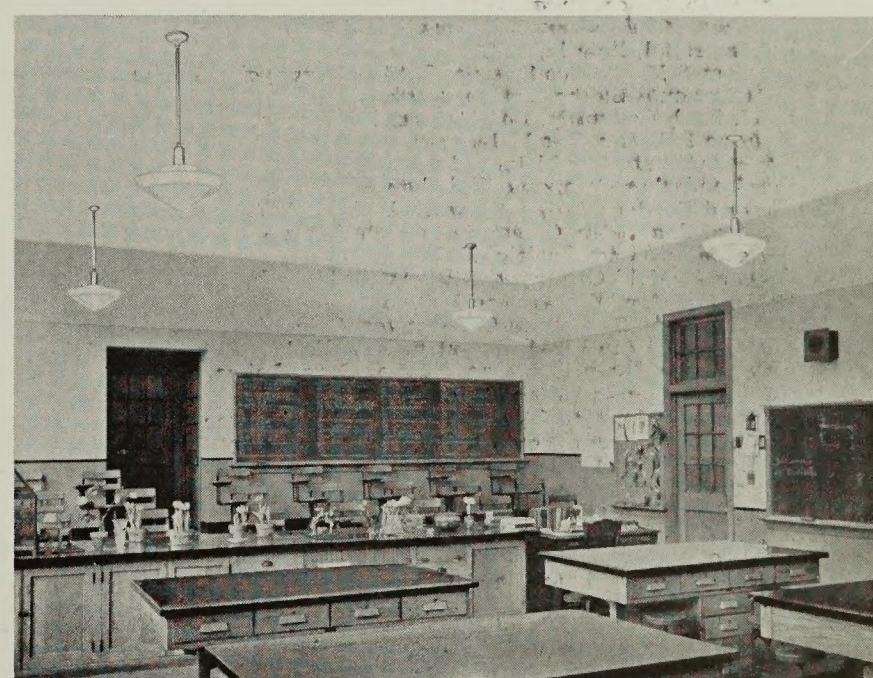
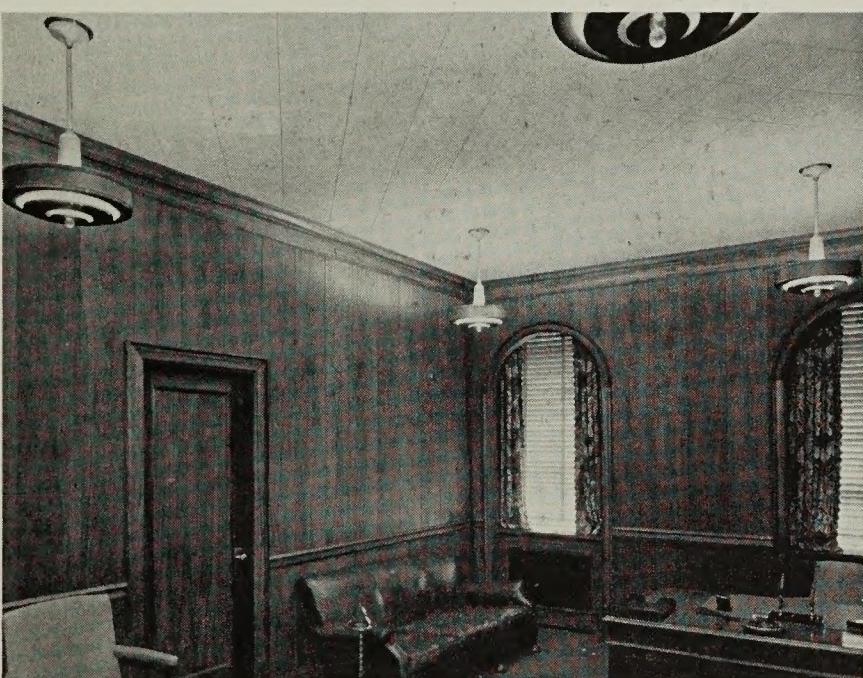
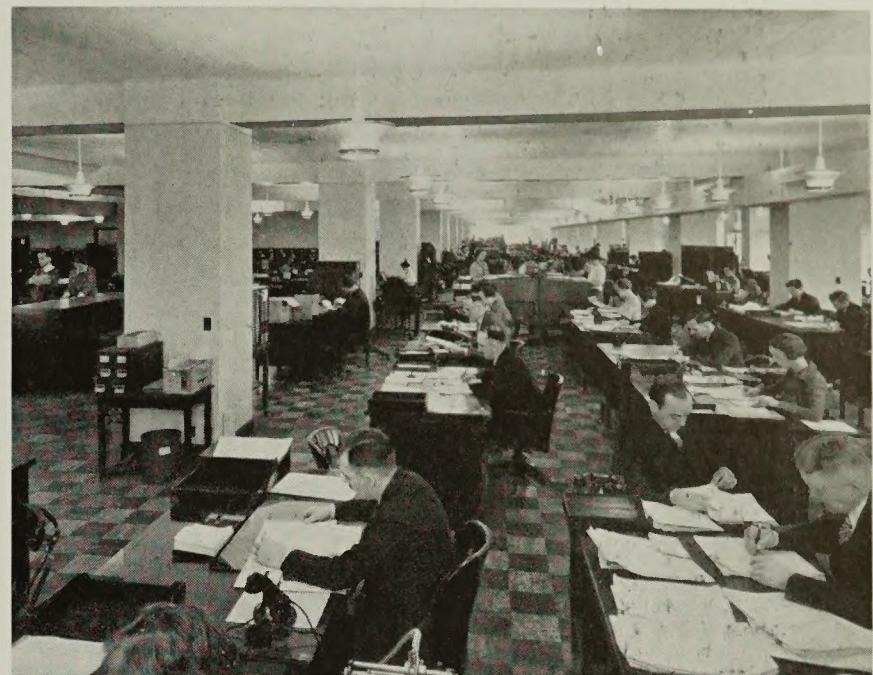
Printed in U. S. A.



## Art Metal Engineered Lighting Equipment Provides Adequate Seeing Conditions



## Illustrating the Versatility of Art Metal Lighting Equipment



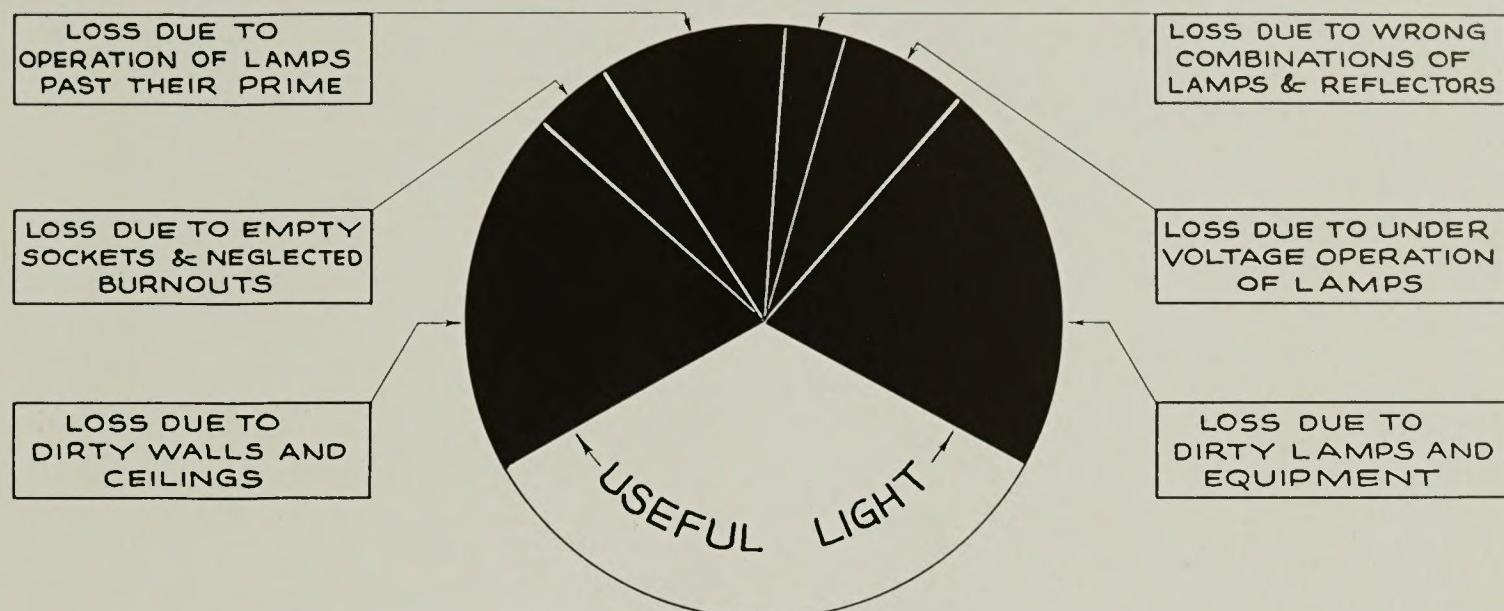
# A Partial List of Companies\* that have installed Art Metal Light Conditioning Equipment

- Adolphus Hotel, Dallas, Texas  
Albany Hospital, Albany, New York  
Albiani's, Boston, Mass.  
Archer Daniels Midland Company, St. Paul, Minn.  
Archer Daniels Midland Company, Minneapolis, Minn.  
Aulsbrook Company, Detroit, Mich.  
Walter Baker Chocolate Mills, Milton, Mass.  
Baldwin Piano Company, Pittsburgh, Pa.  
Belmont Hospital, Worcester, Mass.  
Bendix Corporation, South Bend, Ind.  
Biggs Memorial Hospital, Ithaca, N. Y.  
Boston College High School, Boston, Mass.  
Capitol Theatre Building, Worcester, Mass.  
Church of Christ, Fort Wayne, Ind.  
Chrysler Motors (Air Temp. Division), Des Moines, Ia.  
Chrysler Corporation (De Soto Division), Detroit, Mich.  
Children's State Home, Casper, Wyoming  
C. I. A. College, Denton, Texas  
City Hall, Peoria, Illinois  
Clinton Town Hall, Clinton, Mass.  
Colt's Patent Fire Arms Company, Hartford, Conn.  
Colonnade Company, New York and others  
Columbia National Life Insurance Co., Boston, Mass.  
Columbia School, Hammond, Ind.  
Commodore Perry Hotel (Private Suites), Toledo, Ohio  
Consolidated Laundries, Brooklyn, N. Y.  
Detroit City Schools, Detroit, Mich.  
Dewey-Almy Chemical Company, Cambridge, Mass.  
Durango Junior High, Durango, Wyoming  
Andrew Dutton Company, Boston, Mass.  
Eastman Kodak Company, Rochester, N. Y.  
E. W. Edwards & Sons, Syracuse, N. Y.  
Elks Club, Tonawanda, N. Y.  
Engineers Club, Boston, Mass.  
Fairfax Hotel, Buffalo, N. Y.  
Farmers & Mechanics Savings Bank, Minneapolis, Minn.  
First National Stores, Boston, Mass.  
F. W. Fitch Company, Des Moines, Ia.  
Fleming Building, Des Moines, Ia.  
Flynn Building, Des Moines, Ia.  
Franklin-Baker Company, Hoboken, N. J.  
General Foods Building, New York City, N. Y.  
General Sea Foods Company, Boston, Mass.  
Genesee Building, Buffalo, N. Y.  
Gilman Fanfold Company, Niagara Falls, N. Y.  
Glenville Hospital, Cleveland, Ohio  
Golden Eagle Dry Goods Co., Denver, Colorado  
Governor Clinton Hotel, Kingston, New York  
Great Lakes Naval Training Station, Great Lakes, Ill.  
Julian Goldman's Stores, Syracuse, N. Y.  
Government Printing Office (Cafeteria), Washington, D. C.  
Hammond Civic Auditorium, Hammond, Indiana  
Harvard College (School of Biology), Cambridge, Mass.  
Hercules Powder Co., Wilmington, Del.  
Holy Cross Hospital, Salt Lake City, Utah  
Hospital Building, New Mexico Asylum for Deaf & Dumb,  
Santa Fe, New Mexico  
Hotel Darling, Wilmington, Del.  
Hurley Machine Company, Cicero, Ill.  
Insurance Building, Omaha, Nebr.  
Intermountain Clinic, Salt Lake City, Utah  
Investors Syndicate, Minneapolis, Minn.  
Iowa-Des Moines National Bank Building, Des Moines, Ia.  
James Andrew Jackson Junior High School, Pasadena, Tex.  
The Johnson Store, Bradford, Pa.  
Joyce Hotel (Lobby), Colorado Springs, Colorado  
Kapps Hotel, Rensselaer, New York  
Kerwin's Department Store, Framingham Center, Mass.  
K. L. Z. Broadcasting Studios, Denver, Colorado  
K. L. Z. Transmitter Station, Englewood, Colorado  
Lancer Furniture Company, Rochester, N. Y.  
Leeman Auto Company, Denver Col.  
Libby-Owens-Ford Glass Company, Toledo, Ohio  
Lifkin Stores, Easton, Pa.  
Liquid Carbonic Company, Minneapolis, Minnesota  
Lykes Brothers Insurance Co., Tampa, Fla.  
Mansion House, N. Adams, Mass.  
Marquette Hotel, Peoria, Ill.  
Melrose Hotel, Dallas, Texas  
Midland Steel Company, Detroit, Mich.  
Ministers Life & Casualty Company, Minneapolis, Minn.  
Minnesota National Bank, Duluth, Minn.  
Monterey Hotel, Asbury Park, N. J.  
Municipal Tuberculosis Sanitarium, Chicago, Illinois  
National Automotive Fibres, Inc., Detroit, Michigan  
National Grinding Wheel Co., North Tonawanda, N. Y.  
National Twist Drill & Tool Company, Detroit, Michigan  
Natural History Museum, University of Colorado, Boulder, Colo.  
Newport Naval Hospital, New Wing, Newport, R. I.  
National Tea Company, Chicago, Ill.  
New England Furniture Company, Minneapolis, Minn.  
New Public Works Building, Peabody, Mass.  
News Building, Grand Rapids, Mich.  
News Building, Saginaw, Mich.  
New York State Hospitals (10), State of New York  
New York State Teachers Building, Albany, N. Y.  
Niagara Permanent Savings & Loan, Niagara Falls, N. Y.  
Oldsmobile Company, Lansing, Mich.
- Park Central Hotel, New York City, N. Y.  
Park Lane Hotel, Denver, Colorado  
Paxton Hotel Coffee Shop, Omaha, Nebr.  
People's Store, Troy, New York  
Pierre Marcel Co., Boston, Mass.  
Pioneer Hotel, Amarillo, Texas  
Progressive Aid Insurance Co., Philadelphia, Pa.  
Public Library, St. Joseph, Mo.  
Purdue University, Lafayette, Ind.  
Pure Oil Company, Minneapolis, Minn.  
Purity Bakeries, New York City, N. Y.  
Quincy Electric Light Company, Quincy, Mass.  
Remington-Rand, Inc., Various Cities  
Riviera Restaurant, Buffalo, N. Y.  
Rundel Memorial Library, Rochester, N. Y.  
Russell Miller Company, Portland, Ore.  
Sage-Allen Company, Hartford, Conn.  
Salem Electric Light Company, Salem, Mass.  
San Jose Armory, San Jose, Cal.  
Schiff Shoe Company, Columbus, Ohio  
Shadbolt & Boyd Company, Milwaukee, Wisc.  
Shepard Stores, Boston, Mass.  
Shepard Stores, Providence, R. I.  
Silver Creek Hotel, Silver Creek, N. Y.  
Silverkane Restaurant, Binghamton, N. Y.  
Socony Vacuum Oil Company, New York City  
Standard Oil Company of New York, Albany, New York  
Franklin Simon Company, New York City, N. Y.  
Smith Winchester Company, Jackson, Mich.  
South Shore Towers, Chicago, Ill.  
Southern Casket Company, San Antonio, Texas  
Southern Pacific Railroad Company, San Francisco, Cal.  
Sparks Theatres (8), Florida  
St. Jerome Hospital, Batavia, N. Y.  
Steiger's Store, Springfield, Mass.  
Steuben Building, Chicago, Ill.  
Swift Printing Company, St. Louis, Mo.  
Tacoma Hospital & Sanitarium, Greenville, Tenn.  
Union Pacific Offices, Denver, Colorado  
University of Minnesota, Minneapolis, Minn.  
University Club, Pittsburgh, Pa.  
University of Illinois, Urbana, Ill.  
U. S. Army Post, Fort Niagara, N. Y.  
U. S. National Bank, Vancouver, Wash.  
Walper's Department Store, Chelsea, Mass.  
Warren Apartments, Cheyenne, Wyoming  
Wayne County Building, Detroit, Michigan  
Washburn-Crosby Company, Buffalo, N. Y.  
Warren Allen Carpet Company, Boston, Mass.  
Western Tablet & Stationery Company, St. Joseph, Mo.  
Western United Gas & Electric Co., Aurora and Murphysboro, Ill.  
Worcester Electric Light Company, Worcester, Mass.  
Yale University (Graduate College and Payne Whitney Gym),  
New Haven, Conn.  
Yawman & Erbe Desk Company, Boston, Mass.  
Y. M. C. A., Various Cities  
N. Texas State Teachers College, Denton, Texas  
Southwestern State Teachers College, San Marcus, Texas  
Texas Technological School, Lubbock, Texas  
Public Library, San Angelo, Texas  
Arcadia Theatre, Dallas, Texas  
Oklahoma A. & M College, Stillwater, Oklahoma  
Anglo-California National Bank, San Francisco, California  
Kohler & Chase, San Francisco, California  
Talon Fastener, Inc., San Francisco, California  
City Hall, Boston, Mass.  
Boston Edison Company, Woburn Store, Woburn, Mass.  
Kidder-Peabody Company, Boston, Mass.  
Hale Rubber Company, Quincy, Mass.  
New England T. & T. Company, Providence, R. I.  
Waverly Coop. Bank, Waverly, Mass.  
Masonic Hall, Arlington, Mass.  
Reading Municipal Light Company, Reading, Mass.  
Public Library, Framingham, Mass.  
Town Hall, Framingham, Mass.  
Gold Seal Shoe Company, Boston, Mass.  
Prudential Insurance Company, Boston, Mass.  
Metropolitan Life Insurance Company, Torrington, Conn.  
Clearweave Hosiery Stores (20) Stores  
Russia Cement Company, Gloucester, Mass.  
Standard Oil Company, New York City  
N. J. Zinc Company, New York City  
Abraham & Straus, Brooklyn, New York  
American Business Credit Corporation, New York City  
Towers Hotel, Brooklyn, N. Y.  
New York State Hospital of Mental Diseases, Central Islip, N. Y.  
Bloomfield High School, Bloomfield, New Jersey  
Paterson High School, Paterson, New Jersey  
Public Library, Locust Valley, New York  
Cathedral College, New York City  
Hotel Tudor, New York City  
General Foods, Brooklyn, New York  
Shell Union Oil Corporation, Jackson Heights, New York  
Hotel Gotham, New York City  
Loft, Inc. (5 stores in New York City)  
Personal Finance Company, Various Branches  
New York World's Fair, Draftsmen's Headquarters  
Hotel Fairmount, Jersey City, N. J.

\*Complete or partial installations.

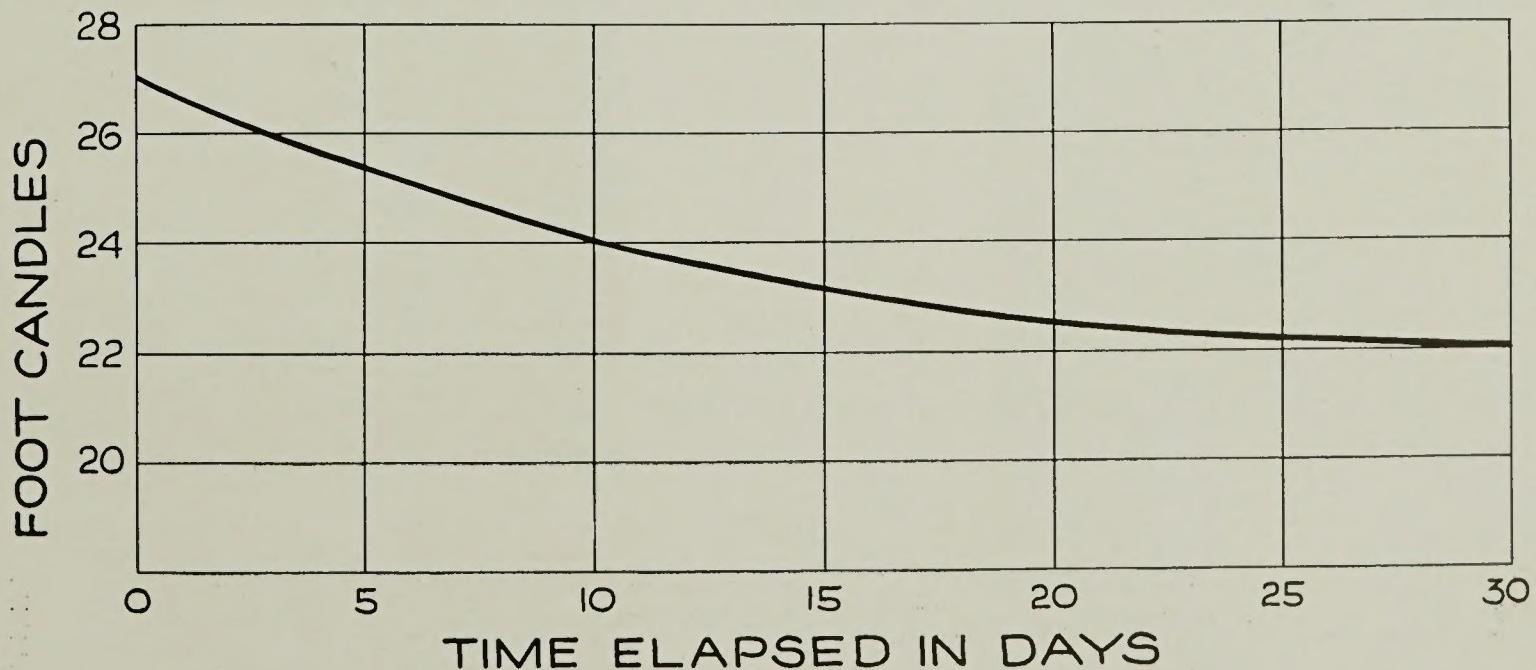
# CONSTANT LIGHTING EFFICIENCY WITH PROPER MAINTENANCE

## CHART SHOWING LOSS OF LIGHT WHEN MAINTENANCE IS NEGLECTED



1. Clean the fixtures once every month.
2. Clean the lamps, do not operate past their prime.
3. Keep correct voltage at the outlet.
4. Operate the fixtures with correct wattage—have no empty sockets.

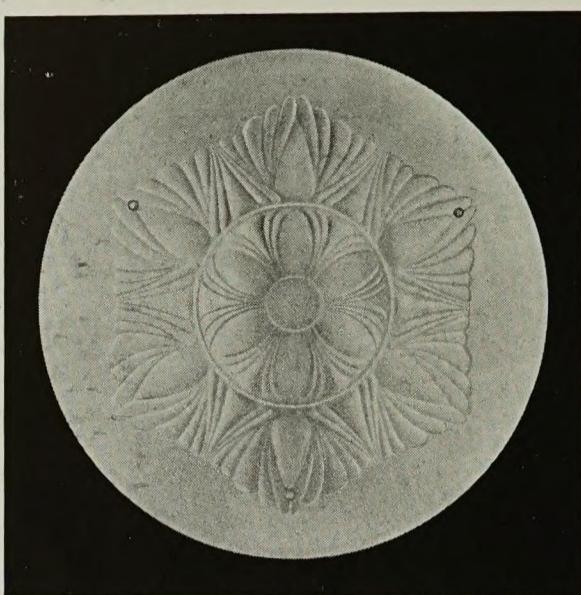
## CHART SHOWING RATE OF DECREASE IN ILLUMINATION



The dust deposited in the first four to six weeks takes the heaviest toll of lighting efficiency, usually about 15 per cent. Consequently, monthly cleaning is advised.

# THE CAPITOL HILUX

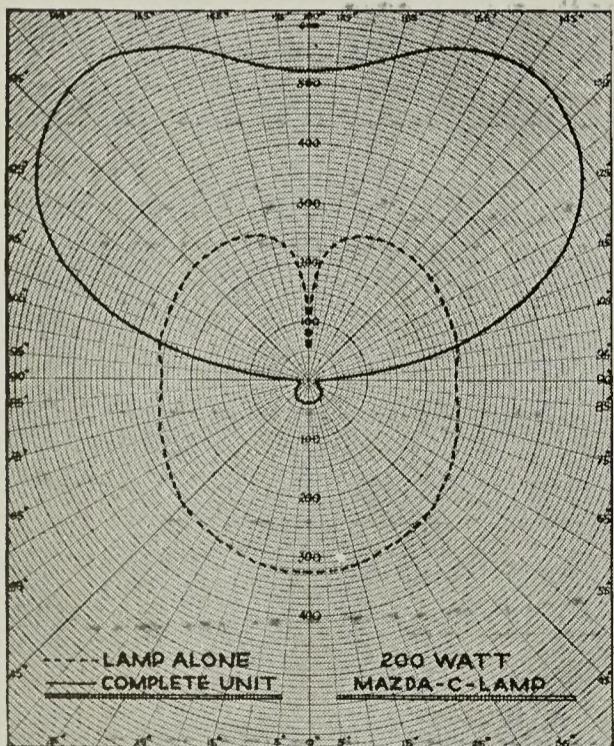
A Dense White Reflecting Glass Made By Corning



Illustrating the beautiful embossed glass.

## THE CAPITOL HILUX GLASS FEATURES

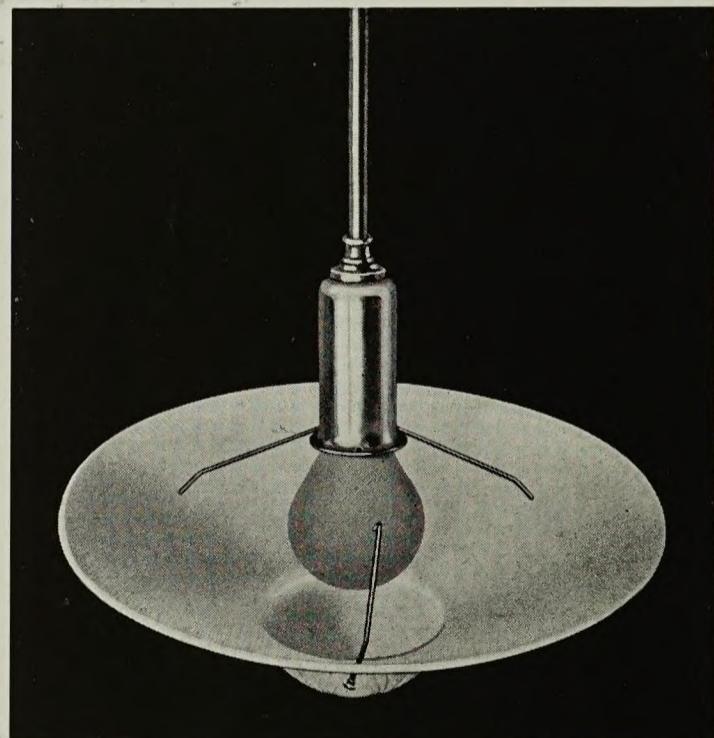
1. A whiter glass when lighted.
2. Constant reflection factor of 83%.
3. Wide upward distribution of light.
4. Low surface brightness.
5. An embossed ornamentation on the glass for surface decoration.
6. Correct light transmission.
7. Easy maintenance, merely release one rod for cleaning or relamping.



The light distribution of the CAPITOL is illustrated by this characteristic curve.

SURFACE BRIGHTNESS VALUES of the Capitol Bowl range from .2 to 1.9 Candle Power per square inch with a 300W Lamp.

(Right) Illustration showing bowl supporting rods with one released for easy maintenance while unit is suspended.



## DATA

No. 1818	Chain Pendant	16" Dia.	30" Suspension	36" O. A.	Medium	200-300W
No. 1818S	Swivel Stem Pendant	16" Dia.	30" Suspension	36" O. A.	Medium	200-300W
No. 1818C	Close Ceiling Style	16" Dia.	30" Suspension	16" O. A.	Medium	200-300W
No. 1819	Chain Pendant	18" Dia.	30" Suspension	37" O. A.	Mogul	300-500W
No. 1819S	Swivel Stem Pendant	18" Dia.	30" Suspension	37" O. A.	Mogul	300-500W
No. 1819C	Close Ceiling Style	18" Dia.	36" Suspension	18" O. A.	Mogul	300-500W
No. 1823	Chain Pendant	22" Dia.	36" Suspension	45" O. A.	Mogul	750-1500W
No. 1823S	Swivel Stem Pendant	22" Dia.	36" Suspension	45" O. A.	Mogul	750-1500W

Standard Finish: Silvertint.

# THE SHELBURNE



Direct-indirect, luminous drum, double thickness flashed opal glass bottom, metal skirt houses Art Metal "Widelite" Corning Glass lens.

No. 1952 20" Dia. 30" Susp. 36" O. A. 300-500W

**Standard Finish:** Silvertint.

**Optional Finish:** Goldtint.

Furnished with a non-light absorbing baffle.



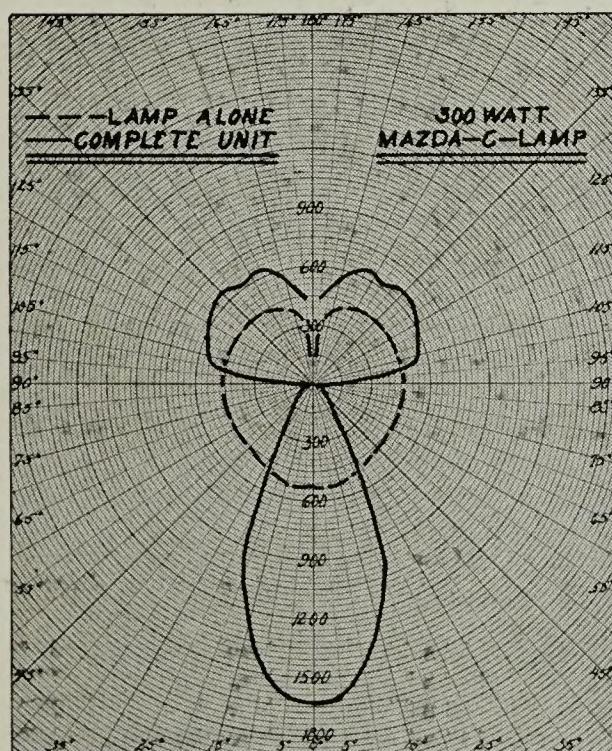
Semi-indirect, luminous drum, double thickness flashed opal glass bottom, polished metal cup.

No. 1951 20" Dia. 30" Susp. 36" O. A. 300-500W

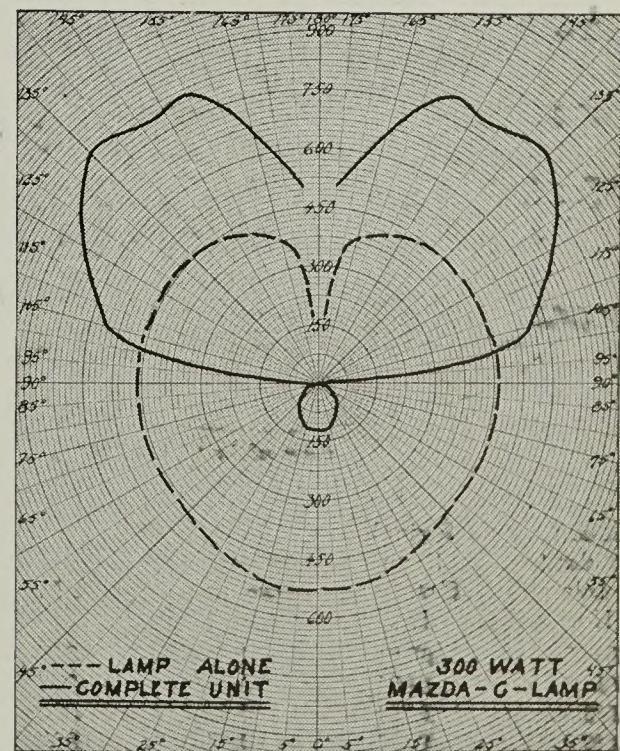
**Standard Finish:** Silvertint.

**Optional Finish:** Goldtint.

Furnished with a non-light absorbing baffle.

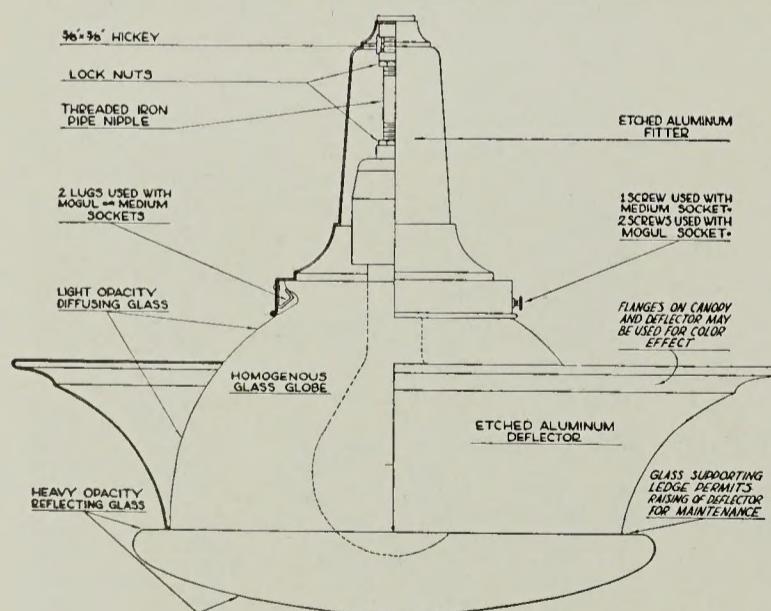


The light distribution is illustrated by these characteristic curves



# THE AMOLIER CLEARTOP

## A Totally Enclosed Homogeneous Glass Globe of Dual Opacity for Semi-Indirect Illumination



Assembly Chart

### AMOLIER DATA

Chain Pendant Catalog No.	Swivel Stem Catalog No.	Suspension Length	O. A. Length	Close Ceiling Catalog No.	O. A. Length	Deflector Diameter	Glass Size	Type Socket	Wattage
6150	6151	30"	36"	6156	15"	18"	9" x 4"	Medium	150W
6200	6201	30"	37"	6206	18"	21½"	12" x 5"	Medium	200W
6250	6251	30"	37"	6256	18"	21½"	12" x 6"	Mogul	300W
6300	6301	30"	39"			26"	14" x 6"	Mogul	500W
1816	1817	36"	47"			30"	18" x 8"	Mogul	1000W

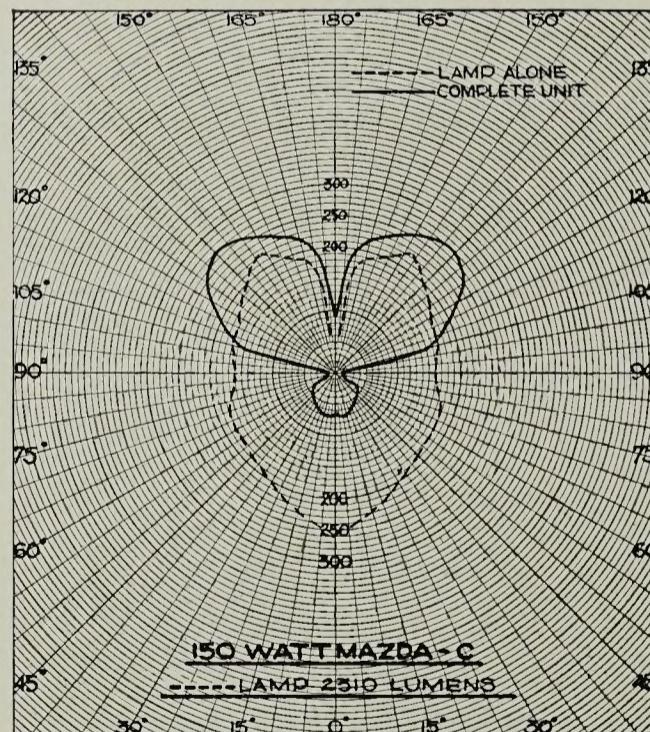
Standard Finish: Silvertint.  
Optional Finish: Goldtint.

### EXCLUSIVE FEATURES

1. Totally enclosed Corning Galax glass globe diffuses the light over a wide area with maximum upward reflection.
2. Metal deflector screens the light source.
3. Low visible surface brightness values.
4. Low maintenance cost.
5. The totally enclosed glass globe keeps out all dirt and insects.
6. The deflector as well as the bottom of the glass globe has a soft luminous effect when lighted.
7. The upper portion of glass is clear for greatest light output . . . no absorption takes place.



Illustrating the totally enclosed Amolier glass globe with Clear glass top and Dense glass bottom before metal deflector is positioned on the glass supporting ledge.



The light distribution of the AMOLIER is illustrated by this characteristic curve.

Surface brightness values of the Galaxy Glass Bottom range from 1.4 to 2.5 candle power per square inch with a 300W lamp in 12" dia. glass.

## THE LOUVRLIER



Direct-indirect luminous metal bowl, with metal concentric louvres. Downlight spread 35° from the vertical.

**No. 1815S** 18" Dia. 30" Susp. 36" O. A. 200W  
**No. 1758S** 22" Dia. 30" Susp. 38" O. A. 300-500W  
**No. 1803S** 30" Dia. 36" Susp. 46" O. A. 750-1000W

**Standard Finish:** Silvertint—Louvres Matt White.

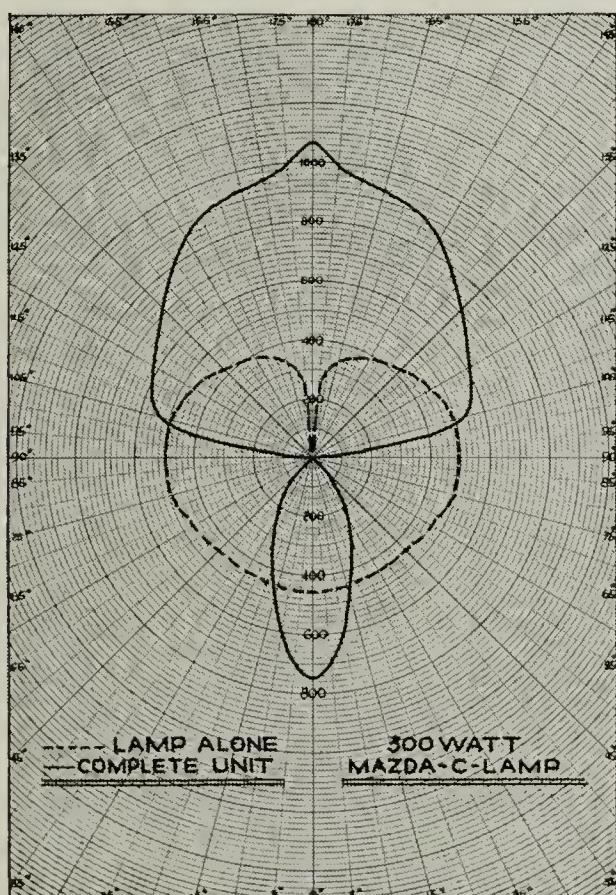
## THE LENSLIER



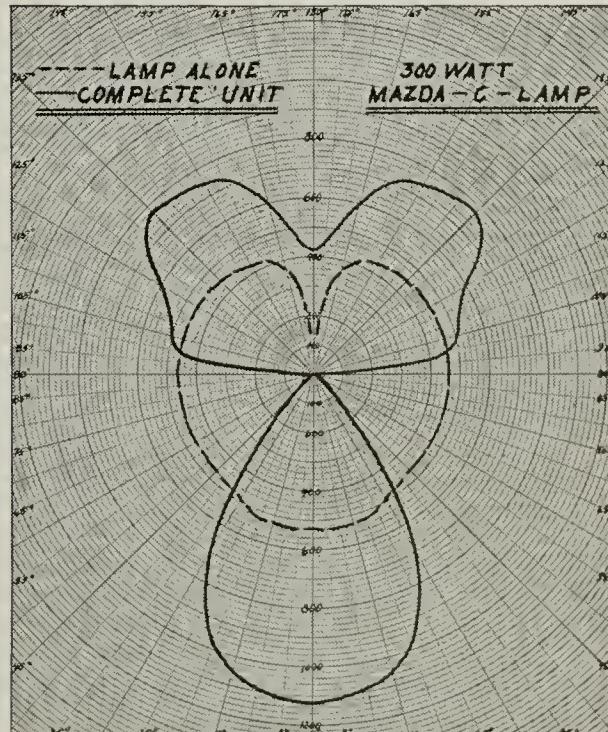
Direct-indirect, using Art Metal "Widelite" Corning glass lens. Downlight spread 45° from the vertical. Opaque metal bowl.

**No. 1930** 22" Dia. 30" Susp. 35" O. A. 300-500W  
**Standard Finish:** Silvertint.  
**Optional Finish:** Goldtint.

Furnished with a non-light absorbing baffle.



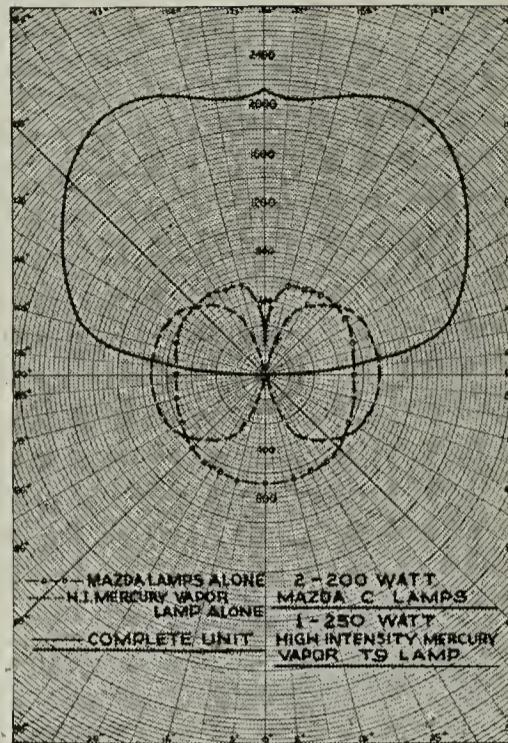
The light distribution of the LOUVRLIER is illustrated by this characteristic curve.



The light distribution of the LENSLIER is illustrated by this characteristic curve.

# THE MERCURYLITE

Combines Mercury and Incandescent Lamps for Lighting  
that Closely Approaches Daylight.



The light distribution of the MERCURYLITE is illustrated by this characteristic curve.

Mercurylite equipment is furnished wired complete for 250 W. H. I. Mercury Vapor Lamp and 2—200 W. Mazda Lamps. NO LAMPS FURNISHED. A specifically designed transformer for 110 volt, 60 cycle circuit is the auxiliary furnished complete with wiring diagram.

● New in the field of illumination the Mercurylite produces a whiter light than ever before obtainable . . . the nearest approach to daylight. Being totally indirect there are no harsh shadows or glare. Having the proper quality and intensity of light output, this new light source materially reduces eye fatigue.

The color quality of the light produced by Mercurylite is the nearest approach to "daylight whiteness" because equal lumens of Mercury Vapor light which contain green, blue and yellow color rays are mixed with equal lumens of Mazda light which

is a continuous spectrum rich in red, producing a synthetic white.

Mercurylite is by no means a "color matching" light source, but, because of the quality of light and the high lumen output, the Mercurylite is the finest artificial lighting obtainable.

In operation the Mercury Lamp has a high lumen output . . . the 250 W. is equivalent to approximately 450 watts of Mazda. The cost of operation is approximately half the cost of operating Mazda Lamps of the same lumen output.

## DATA

Cat. No.	Aux. Equip. Mounting	Diameter	Length Overall	Mazda Wattage	H. I. Mercury Wattage	Auxiliary Equipment
9006	- Canopy	21½"	38	2—200W	250W	110 V, 60 Cycle Transformer

Standard Finish: Silvertint.

This equipment operates only on A. C. current.

## THE RADILUX



Direct-indirect—the inner glass reflector directs a greater percent of light down. Metal concentric bottom louvres. Metal deflector.

No. 1946 22" Dia. 30" Susp. 34" O. A. 300-500W

Standard Finish: Silvertint—Louvres Matt. White.

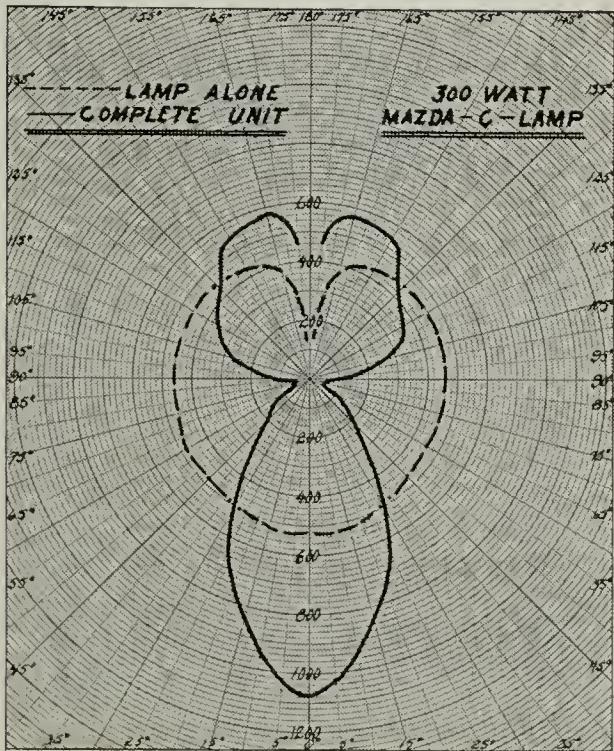
## THE EQUALITE



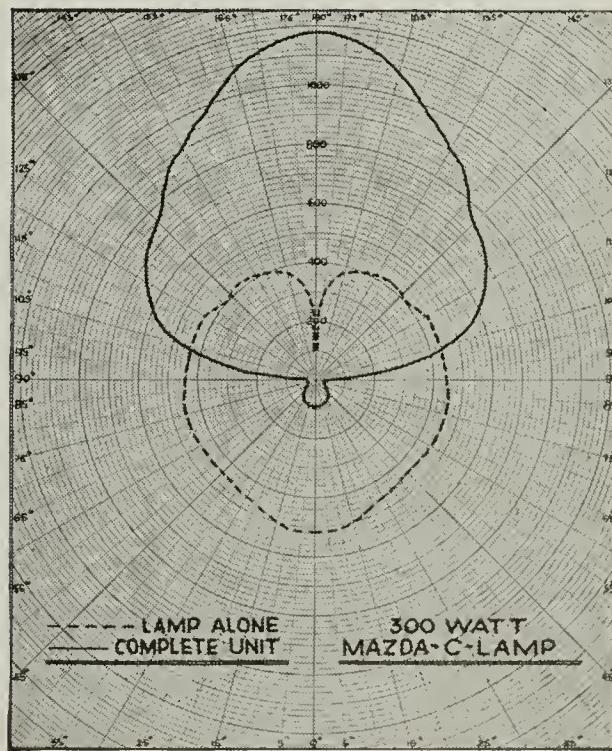
Semi-indirect with luminous bowl and white Monax glass bottom plate.

Swivel Stem Pend.	Chain Pend.	Dia.	Susp.	O. A.	Wattage
<b>No. 1732S</b>	<b>No. 1732</b>	18"	30"	38"	300-500W

Standard Finish: Silvertint.



The light distribution of the NEW DIRECTALIER is illustrated by this characteristic curve.



The light distribution of the EQUALITE is illustrated by this characteristic curve.

## THE REGAL



Indirect with luminous metal bowl.

No. 1956 18" Dia. 30" Susp. 36" O. A. 300-500W

**Standard Finish:** Silvertint.

Furnished with non-light absorbing baffle.

## THE PLASTICLITE

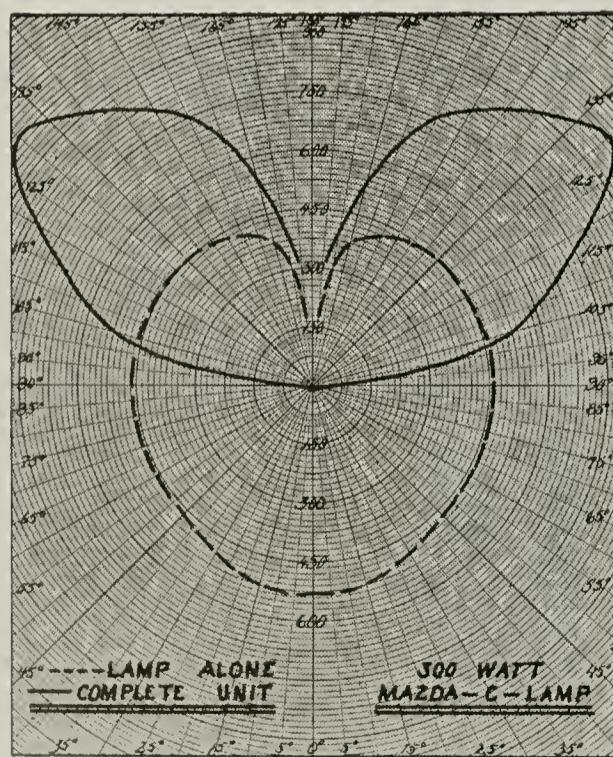


Semi-indirect plastic bowl.

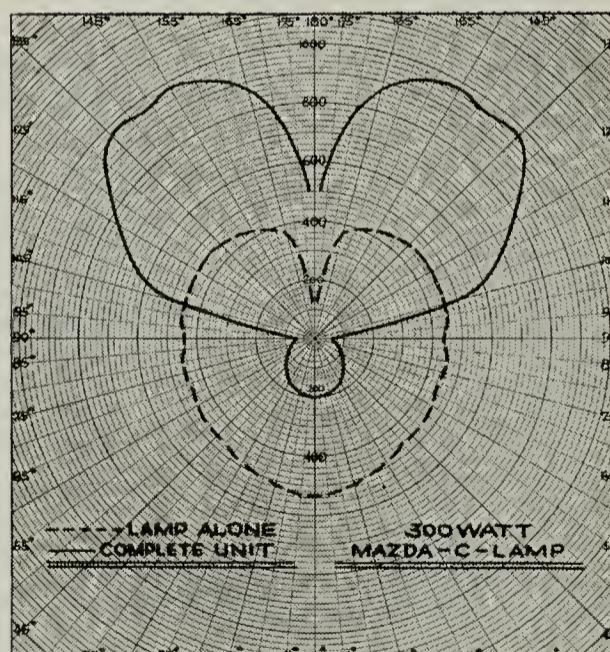
No. 1860 18½" Dia. 30" Susp. 37" O. A. 300-500W

**Standard Finish:** Silvertint.

Furnished with a non-light absorbing baffle



The light distribution of the REGAL is illustrated by this characteristic curve.



The light distribution of the PLASTICLITE is illustrated by this characteristic curve. SURFACE BRIGHTNESS VALUES of the Plasticlite Bowls range from .8 to 1.98 candle power per sq. in. with a 300W lamp.

## THE LOUVRPLASTIC



Semi-indirect plastic bowl with concentric metal louvre downlight control.

**No. 1944** 18 $\frac{5}{8}$ " Dia. 30" Susp. 36" O. A. 300-500W

**Standard Finish:** Silvertint—Louvres Matt White.

Furnished with non-light absorbing baffle.

## THE LENSPLASTIC

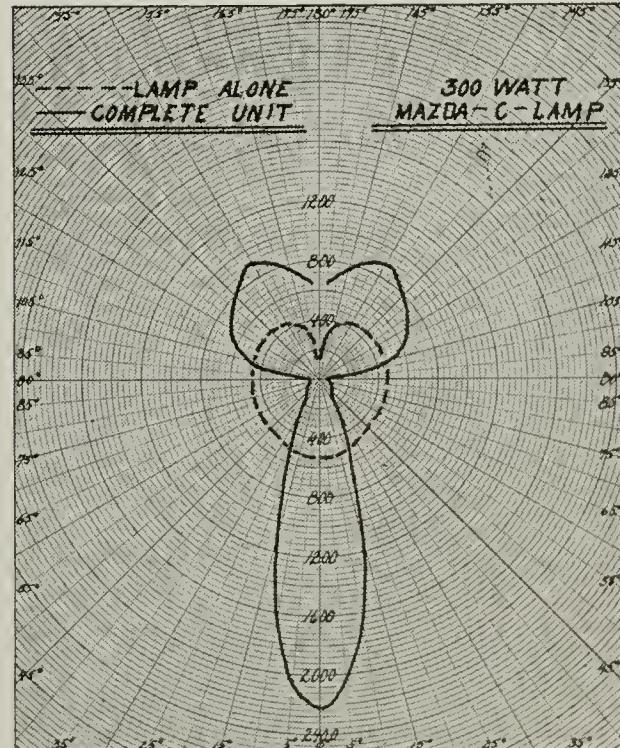
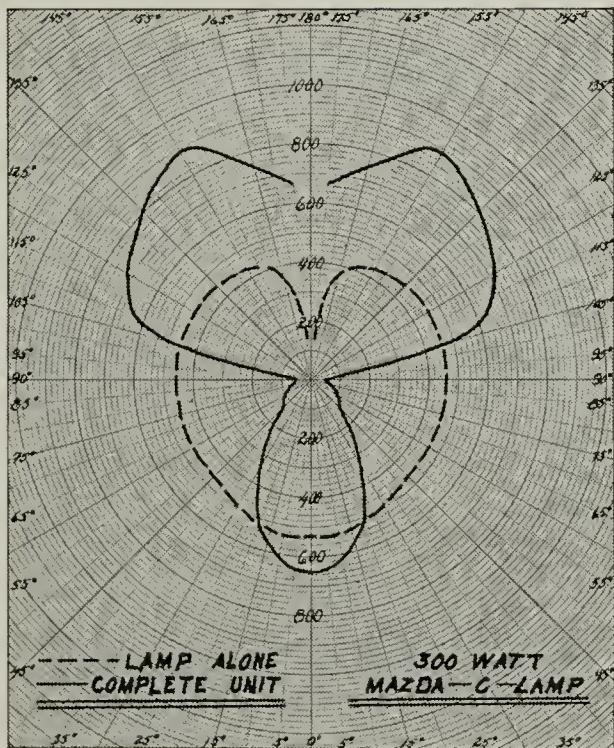


Semi-indirect plastic bowl with Art Metal "Widelite" Corning glass lens downlight control.

**No. 1943** 18 $\frac{5}{8}$ " Dia. 30" Susp. 36" O. A. 300-500W

**Standard Finish:** Silvertint.

Furnished with non-light absorbing baffle.



The light distribution curves illustrate the control of the light up for semi-indirect general illumination and directly down for concentrated localized lighting . . . The Direct downlighting is controlled by concentric metal louvres or by the Art Metal "Widelite" Corning glass lens.

## THE STREAMLITE



Semi-indirect luminous bowl with concentric lined white Monax glass bottom plate.

No. 1863 22" Dia. 30" Susp. 36" O. A. 300-500W

Standard Finish: Silvertint.

## THE EQUALIER

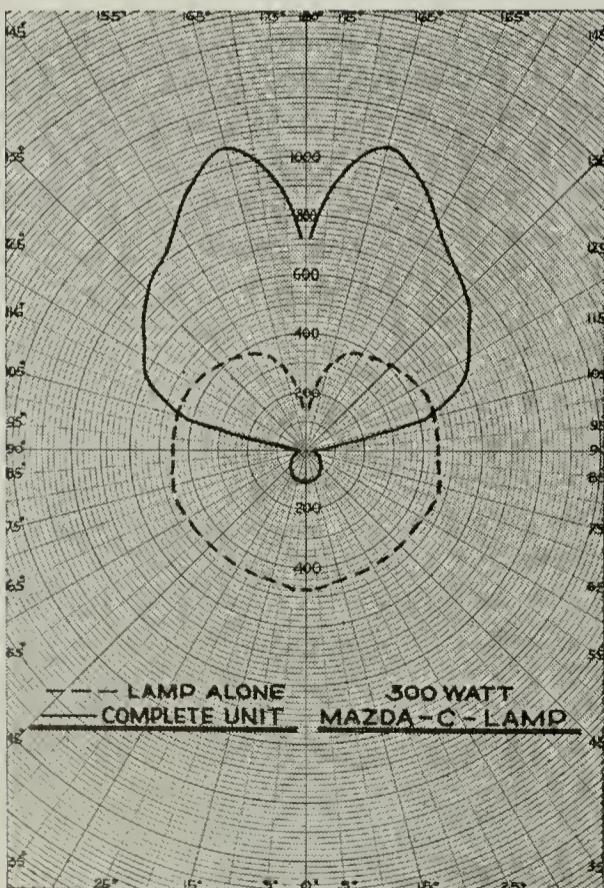


Semi-indirect luminous drum with a double thickness flashed opal bottom glass with a 5 1/2" dia. louvred metal plate and crystal ball.

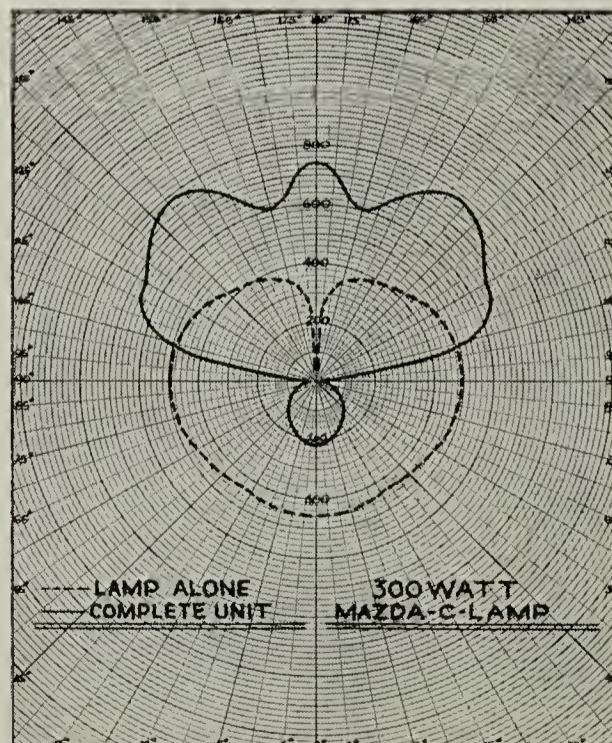
No. 1830S 18" Dia. 30" Susp. 36" O. A. 300W

Standard Finish: Silvertint.

Optional Finish: Goldtint.



The light distribution of the STREAMLITE is illustrated by this characteristic curve.



The light distribution of the EQUALIER is illustrated by this characteristic curve.

# 147

## THE DISTRIBUTOR



Indirect shallow metal bowl for "PS" lamps only.

Swivel Stem Pend.	Chain Pend.	Dia.	Susp.	O. A.	Wattage
No. 1733S	No. 1733	22"	30"	36"	300-500W
No. 1761S	No. 1761	18"	30"	35"	300W
No. 1762S	No. 1762	18"	30"	35"	200W
No. 1802S		30"	36"	45"	750-1500W

**Standard Finish:** Silvertint.

Alzak finish obtainable on 18" and 22" dia. only.

## The Broadcaster for Bipost Lamp

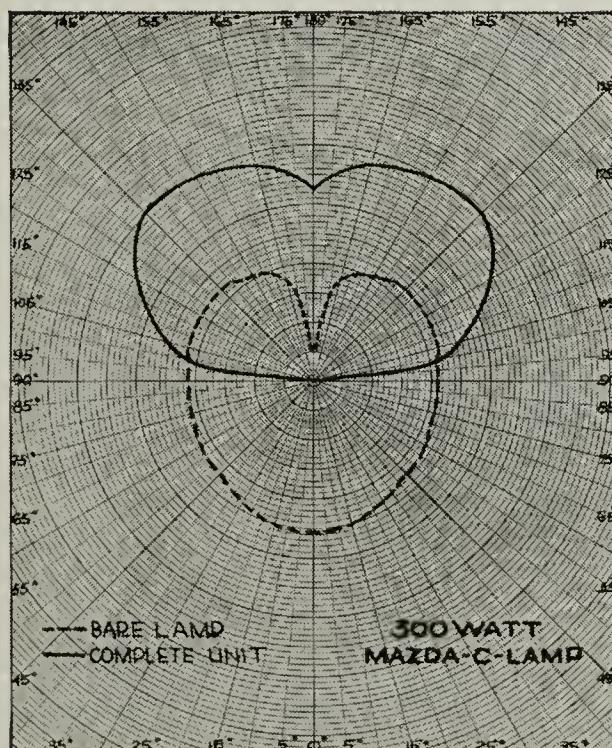


Indirect shallow metal bowl with luminous bottom effect.  
For Bipost Lamps only.

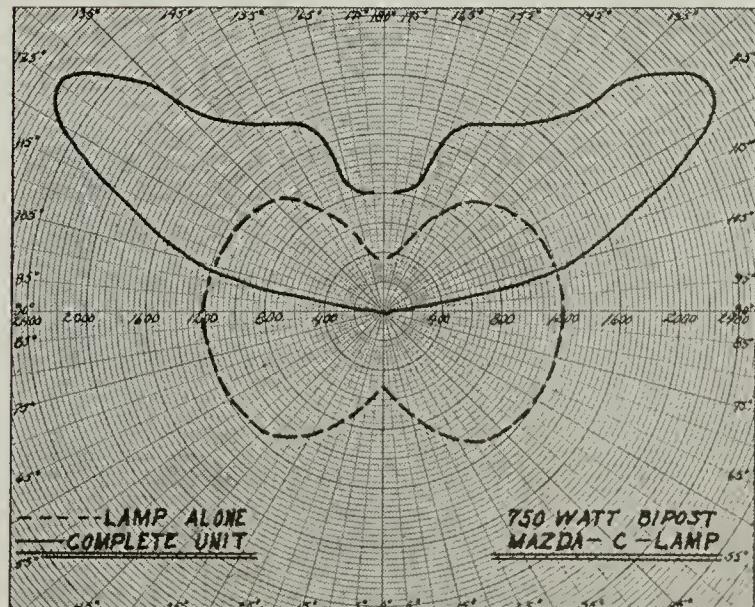
**No. 1947** 22" Dia. 30" Susp. 36" O. A. 750-1000W Bipost

**Standard Finish:** Silvertint.

Furnished with a non-light absorbing baffle.



The light distribution of the DISTRIBUTOR  
is illustrated by this characteristic curve.



The light distribution of the BROADCASTER  
is illustrated by this characteristic curve.

# THE MURALIER

Reflects Colored Light On the Outside Surface Of the Fixture  
Changeable At Will . . . The Projected Light Is White

Muralier light sources supply illumination that is sparkling white plus the added feature of

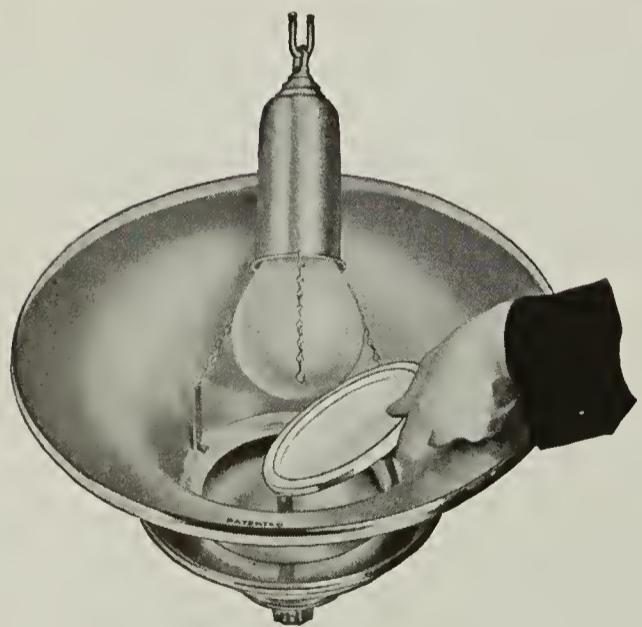
color control . . . changeable transmitted color that is confined within the area of the fixture.



Muralier Standard No. 8028



Muralier Eclipse No. 1862



No. 8018 Chain Pendant  
No. 8028 Swivel Stem Pendant  
No. 1862 Swivel Stem Pendant  
**Standard Finish:** Silvertint.  
**Optional Finish:** Goldtint.

18" Dia.	30" Suspension	41" O. A.	Mogul	300-500W
18" Dia.	30" Suspension	41" O. A.	Mogul	300-500W
22" Dia.	30" Suspension	38" O. A.	Mogul	300-500W

## GLASS COLOR FILTER DATA

Muralier Bowl Diameter 22"	Filter Diameter 5"
18"	6 3/8"

Catalog No.	
Red Filter	8508
	8500

Catalog No.	
Amber Filter	8509
	8501

Catalog No.	
Green Filter	8510
	8502

Catalog No.	
Blue Filter	8511
	8503

**Catalog No. 8517**—A combination filter in which is grouped segments of the four primary colors to give Muralier an alluring chromatic effect, is available for 18" Bowl Diameter Fixtures only.

## THE MURALIER FORMALITE



Indirect with luminous louvres and crystal star bottom decoration . . . Color control feature allows outside surface of louvred bowl to be tinted red-green-amber-blue or chromatic . . . changeable at will.

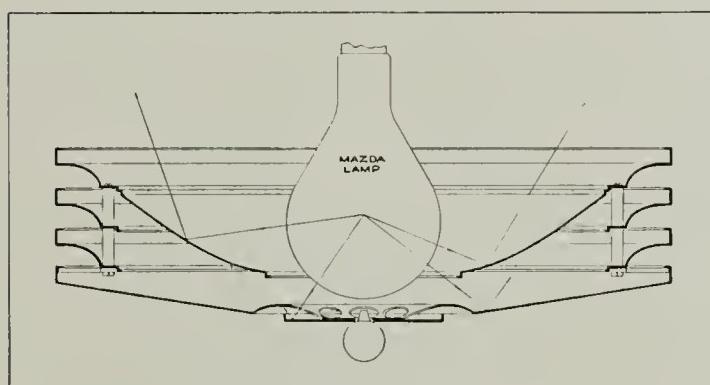
Swivel Stem Pend.	Chain Pend.	Dia.	Susp.	O. A.	Wattage
No. 1786S	No. 1786	15 $\frac{1}{4}$ "	30"	36"	200-300W
No. 1787S	No. 1787	20"	30"	37"	300-500W

Standard Finish: Silvertint.

Optional Finish: Goldtint.

### Glass Color Filter Data for Muralier Formalite Either 15 $\frac{1}{4}$ " or 20" Dia. Size.

No. 8500	Red	Color Filter
No. 8501	Amber	Color Filter
No. 8502	Green	Color Filter
No. 8503	Blue	Color Filter
No. 8517	Chromatic	Color Filter



Cross Section Drawing

This cross sectional drawing and characteristic curve are descriptive of both the above Muralier Formalite and the Formalier.

## THE FORMALIER

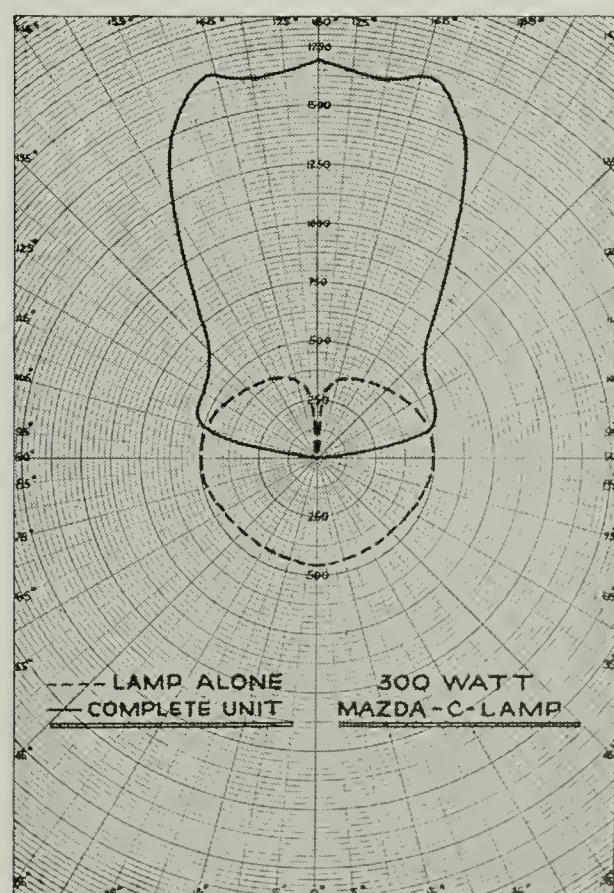


Indirect with luminous louvres. Crystal star bottom decoration. No color control.

No. 1783S 24" Dia. 36" Susp. 45" O. A. 750-1000W

Standard Finish: Silvertint.

Optional Finish: Goldtint.



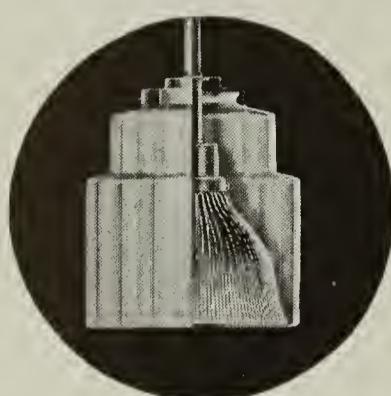
# THE HALE UNIT—DIRECT LIGHTING



No. 1660

No. 1660 L with Concentric Louvres

The HALE UNIT is designed to give quantity illumination for effective down lighting. The fact that the HALE UNIT concentrates 85% of the light down and 15% upward solves the lighting problem economically for direct illumination and decidedly increases over-all efficiencies. This scientific control of light is due to special patented design and construction. The exterior light diffusing opal glass



(PATENTED)

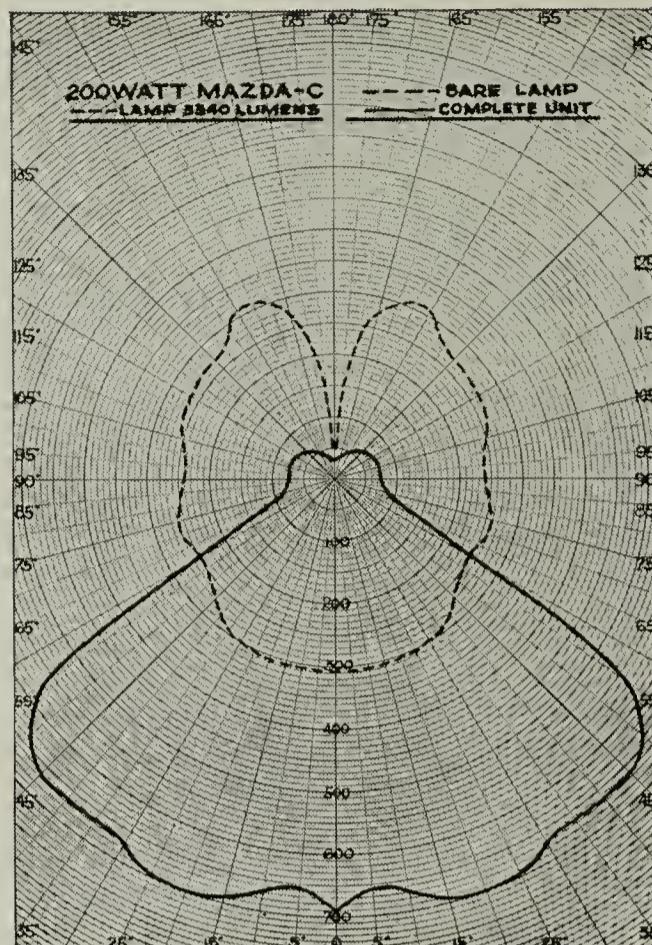
The above illustration shows the construction of the Hale Unit. The outer glass globe, which is a highly diffusing glass, rests on a stationary and correctly positioned support. This glass has a standard 5" fitter for the 200 W. size. It can easily be raised from its support for maintenance.

The inner prismatic glass reflector is held in position with a standard 3½" fitter.

The position of the glass support is determined by the focal position of the Mazda Lamp and is made rigid in the construction of the fixture to prevent any variance in the focal position—thus always assuring correct operation.

Outside glass 5" fitter, 12½" O. A., Maximum Diameter 11".

Inner reflector 3½" fitter, 7¾" O. A., Maximum Diameter 9¾".



The light distribution of the HALE UNIT is illustrated by this characteristic curve.

SURFACE BRIGHTNESS VALUES on the side of the outer Monax Glass range from .2 to .6 Candle Power per square inch with a 200W Lamp.

provides general illumination and the inner prismatic reflector provides the efficient, direct illumination.

Concentric directional louvres are available for the Hale Unit illustrated above—merely add the letter "L" to the standard catalog number when ordering if HALE UNIT is desired complete with concentric louvres.

## HALE UNIT DATA

**Listing is Complete Including Prismatic Reflector**

Cat. No.

**1660**

Type

Swivel Stem Pend.

Length  
Overall

36"

Wired  
Medium

Wattage  
200

1660L—Same as above except with Concentric Matt White Metal Bottom Louvres.

Standard Finish: Pewter.

## THE PREMIER



Indirect Luminous Metal Bowl.

Swivel Stem Pend.	Chain Pend.	Dia.	Susp.	O. A.	Wattage
No. 1813S	No. 1813	18"	30"	35"	200W
No. 1759S	No. 1759	22"	30"	37"	300-500W
No. 1801S	No. 1801	30"	36"	45"	750-1500W

**Standard Finish:** Silvertint.

## THE MODERNLUX



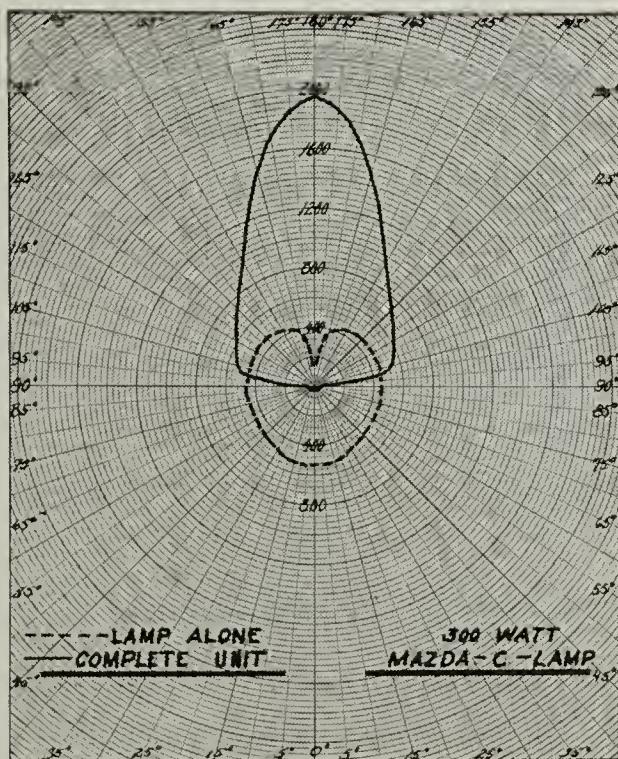
Semi-indirect luminous louvres with concentric lined white Monax glass bottom plate.

**No. 1953** 22" Dia. 30" Susp. 36" O. A. 300-500W

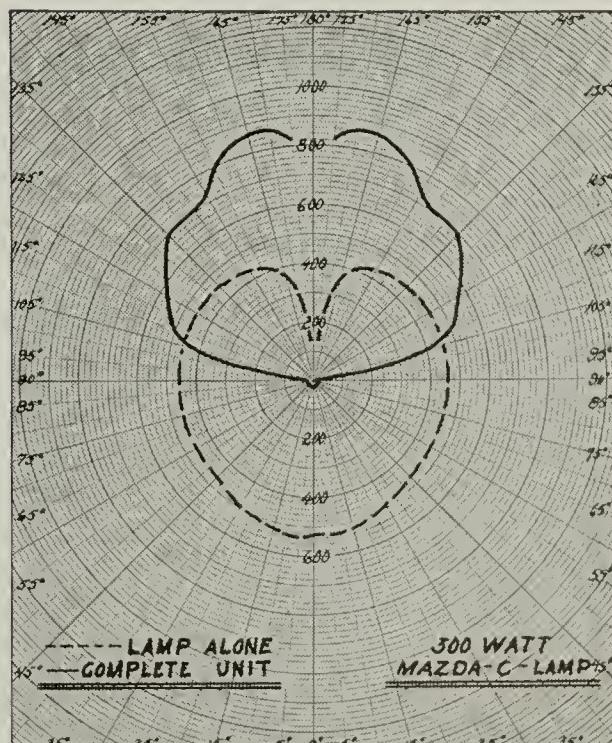
**Standard Finish:** Silvertint.

**Optional Finish:** Goldtint.

Furnished with a non-light absorbing baffle.



The light distribution from the PREMIER is illustrated by this characteristic curve.



The light distribution of the MODERNLUX is illustrated by this characteristic curve.

## THE AERIAL



Semi-indirect with luminous Denax glass cup in bottom.

**No. 1781S** 18" Dia. 30" Susp. 35" O. A. 200-300W  
**No. 1812S** 18" Dia. 30" Susp. 35" O. A. 300W  
**No. 1782S** 22" Dia. 30" Susp. 36" O. A. 300-500W

**Standard Finish:** Silvertint.

**Optional Finish:** Goldtint.

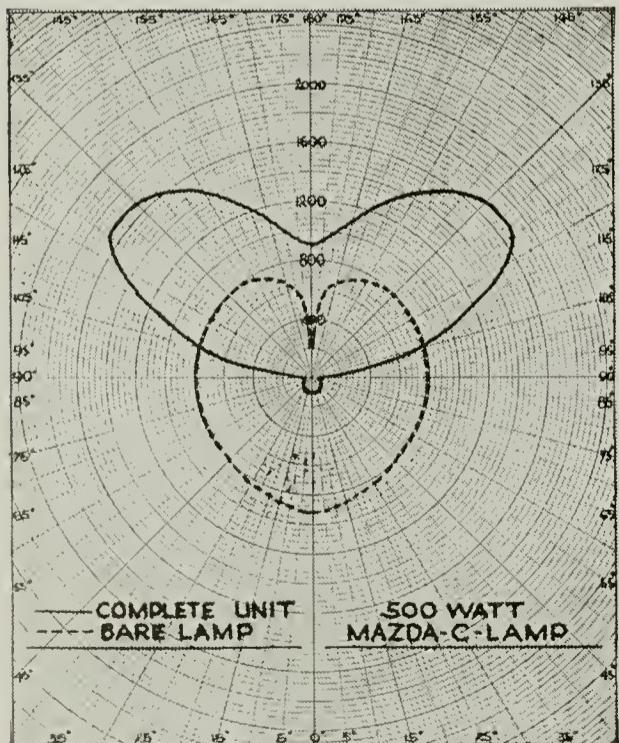
## THE CONILIER



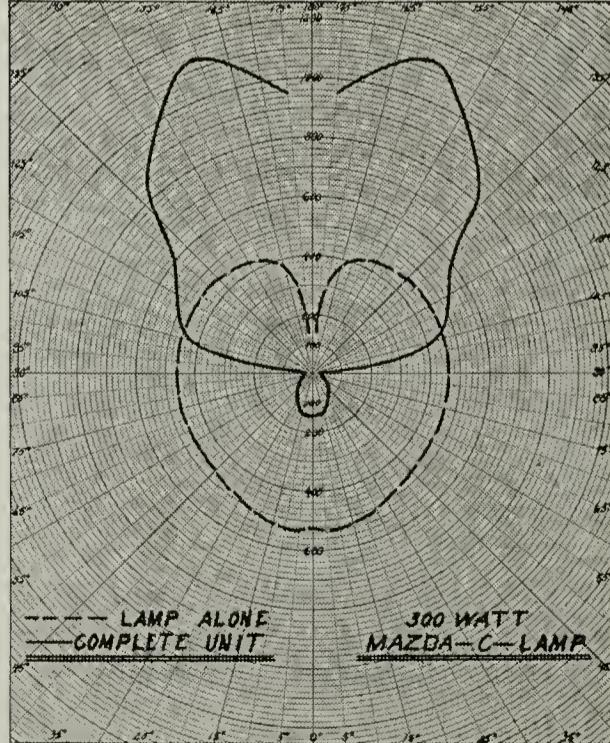
Semi-indirect with luminous bowl and conical white Monax glass bottom plate.

**No. 1949** 18" Dia. 30" Susp. 36" O. A. 300-500W

**Standard Finish:** Silvertint.



The light distribution of the AERIAL is illustrated by this characteristic curve.



The light distribution of the CONILIER is illustrated by this characteristic curve.

## THE PARLUX



Indirect with luminous metal bowl.

Swivel Stem Pend.	Chain Pend.	Dia.	Susp.	O. A.	Wattage
No. 1788S	No. 1788	18"	30"	38"	300-500W

**Standard Finish:** Silvertint.

## THE ULTRALITE

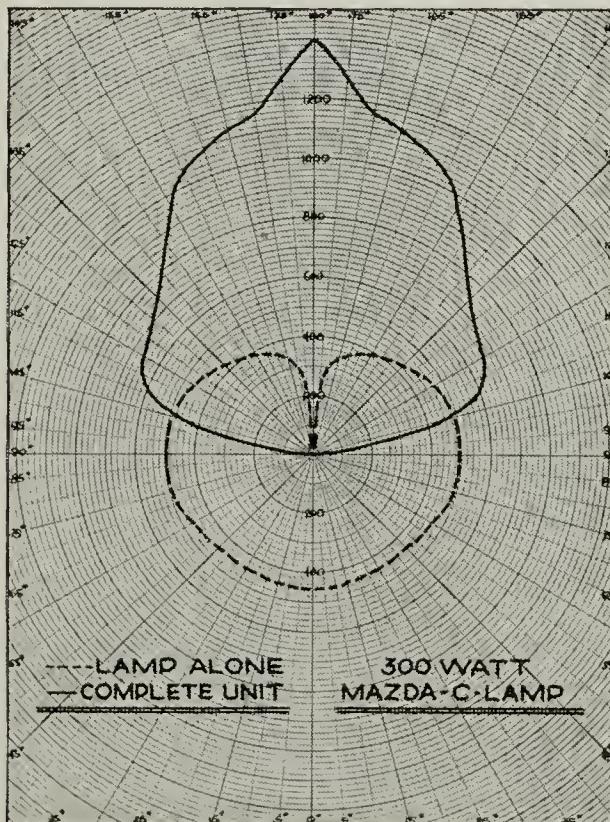


All metal indirect with luminous ring on bottom surface.

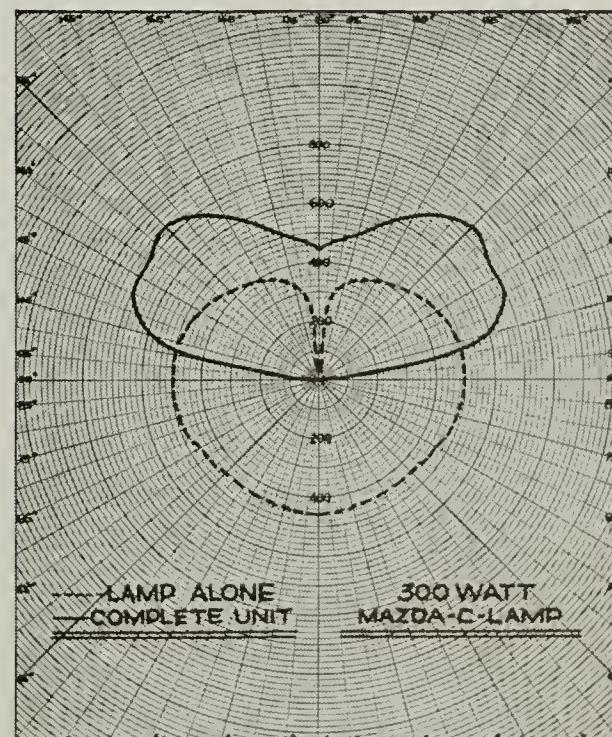
**No. 1780S** 20" Dia. 30" Susp. 36" O. A. 300-500W

**Standard Finish:** Silvertint.

**Optional Finish:** Goldtint.



The light distribution of the PARLUX is illustrated by this characteristic curve.



The light distribution of the ULTRALITE is illustrated by this characteristic curve.

## THE AEROLUX



Semi-indirect luminous bowl with concentric lined white Monax glass bottom plate.

No. 1915 18" Dia. 30" Susp. 36" O. A. 300-500W

Standard Finish: Silvertint.

Furnished with a non-light absorbing baffle.

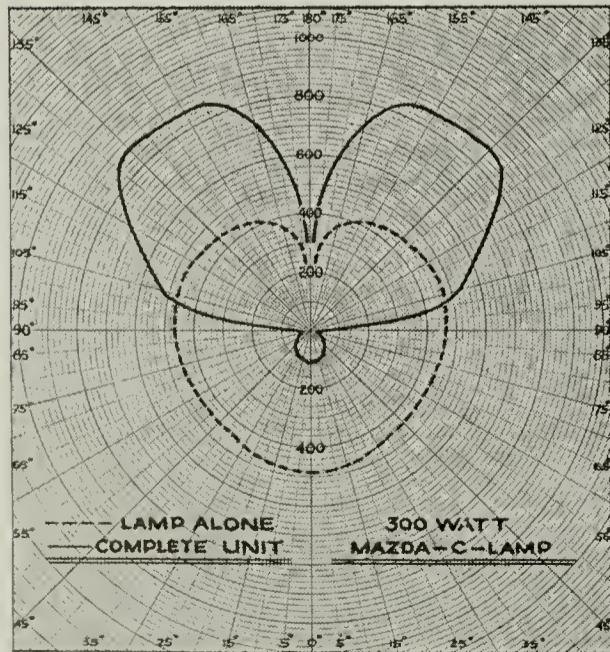
## THE ROYALIER



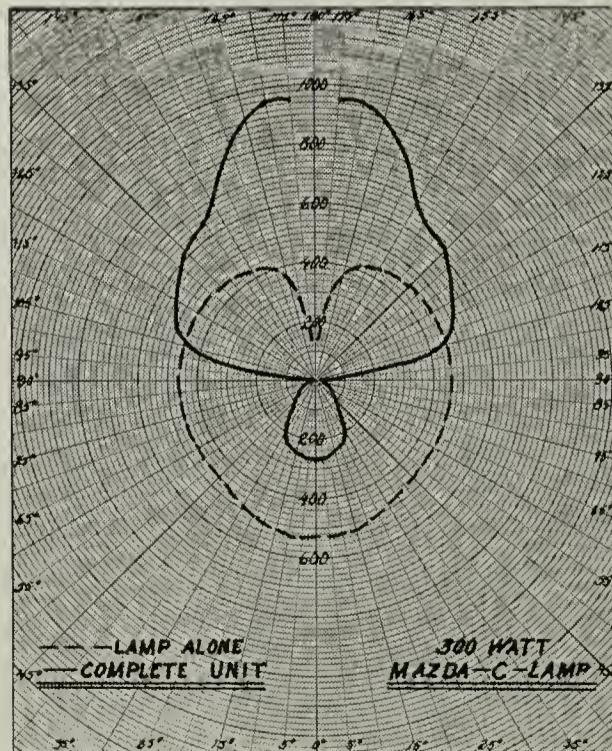
Semi-indirect luminous bowl with embossed pebbled glass bottom plate.

No. 1948 22" Dia. 30" Susp. 36" O. A. 300-500W

Standard Finish: Silvertint.



The light distribution of the AEROLUX  
is illustrated by this characteristic curve.



The light distribution from the ROYALIER  
is illustrated by this characteristic curve.

## THE REGENT STANDARD



Semi-indirect luminous bowl with embossed Denax glass bottom plate.

No. 928 18" Dia. 30" Susp. 37" O. A. 300-500W

**Standard Finish:** Silvertint.

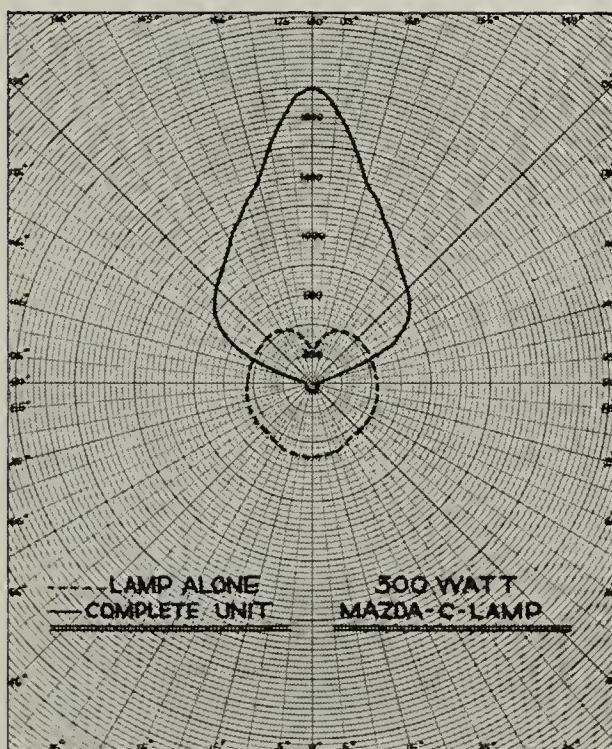
## THE SUPERLUX



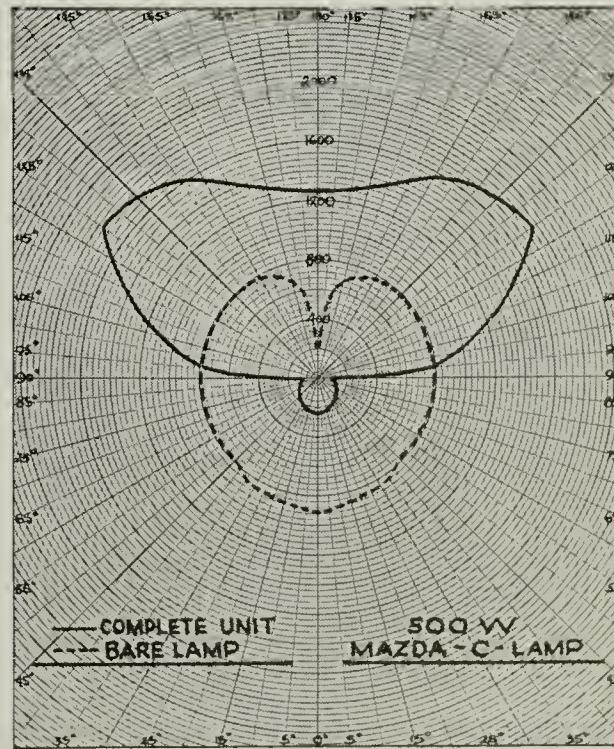
Semi-indirect with Denax glass bowl.

No. 1805S 22" Dia. 30" Susp. 36" O. A. 300-500W

**Standard Finish:** Silvertint.

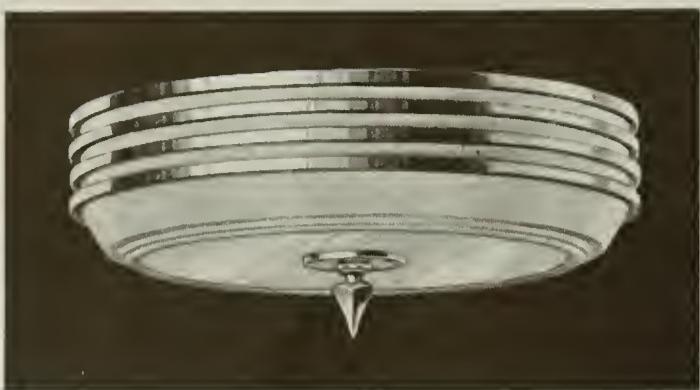


The light distribution of the REGENT Standard is illustrated by this characteristic curve.



The light distribution of this SUPERLUX is illustrated by this characteristic curve.

# SPECIAL LOCATION LIGHTING



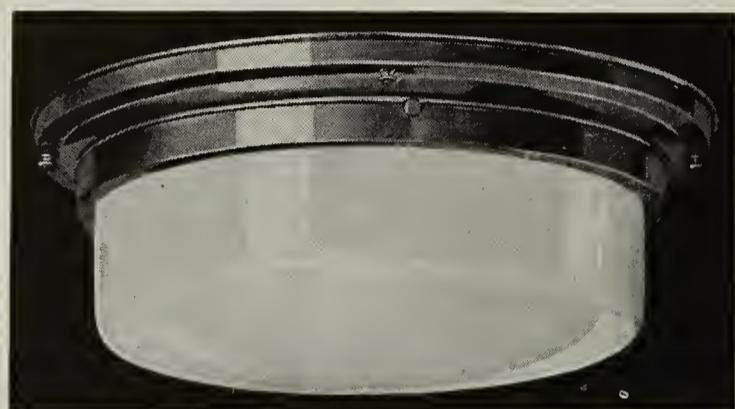
No. 1763

	Dia.	O. A.	Lts.	
<b>No. 1763</b>	15"	6"	2	300W
<b>No. 1746</b>	11¾"	3⅞"	2	200W

**Standard Finishes:** Ivory and Gold, Goldtint, Silvertint, Empire White. Double thickness Flashed Opal Glass Bottom Plate.



No. 1746



One-piece shallow band with white Monax glass.

<b>No. 1738</b>	Glass 8"x2½"	Band 8½" Dia.	2 Soc.	2-40W
<b>No. 1739</b>	Glass 10"x3"	Band 10½" Dia.	2 Soc.	2-100W
<b>No. 1808</b>	Glass 12"x4"	Band 12½" Dia.	2 Soc.	2-100W
<b>No. 1809</b>	Glass 14"x4½"	Band 14½" Dia.	3-Soc.	3-100W

**Finish:** Statuary Bronze—Pewter—Chromium.

Two-piece hinged band with white Monax glass. Also furnished with rugged electric welded wire guard.

<b>No. 216</b>	Glass 12"x4"	Band 14" Dia.	2 Soc.	2-100W
<b>No. 216G</b>	Same as 216—Guarded	9" O. A.		
<b>No. 217</b>	Glass 10"x3"	Band 12" Dia.	2 Soc.	2-100W
<b>No. 217G</b>	Same as 217—Guarded	8½" O. A.		
<b>No. 218</b>	Glass 14"x5"	Band 16" Dia.	3 Soc.	3-100W
<b>No. 218G</b>	Same as 218—Guarded	9½" O. A.		

Made of 22GA Brass—Complete with Reflector Plate and Cross Bar

**Finish:** Statuary Bronze—Pewter—Chromium.



No. M 1402

## MURALIER WALL POCKET DATA

Cat. No.	Dia.	Ex.	O. A.	Wired Wattage
<b>M8001</b>	12"	5¾"	10"	Med. 100W
<b>M1402</b>	9"	4"	8¼"	Med. 60W

Wired complete with switch.

**Finish:** Silvertint.

## GLASS COLOR FILTER DATA FOR EITHER M8001 OR M1402

- No. 8518**—Red Color Filter
- No. 8519**—Amber Color Filter
- No. 8520**—Green Color Filter
- No. 8521**—Blue Color Filter



No. M 8001



**No. 1785** 15½" Dia. 12½" O. A. 500W

No switch furnished.

**Finish:** Silvertint.

**No. 1829** 12" Dia. 10" O. A. 150W

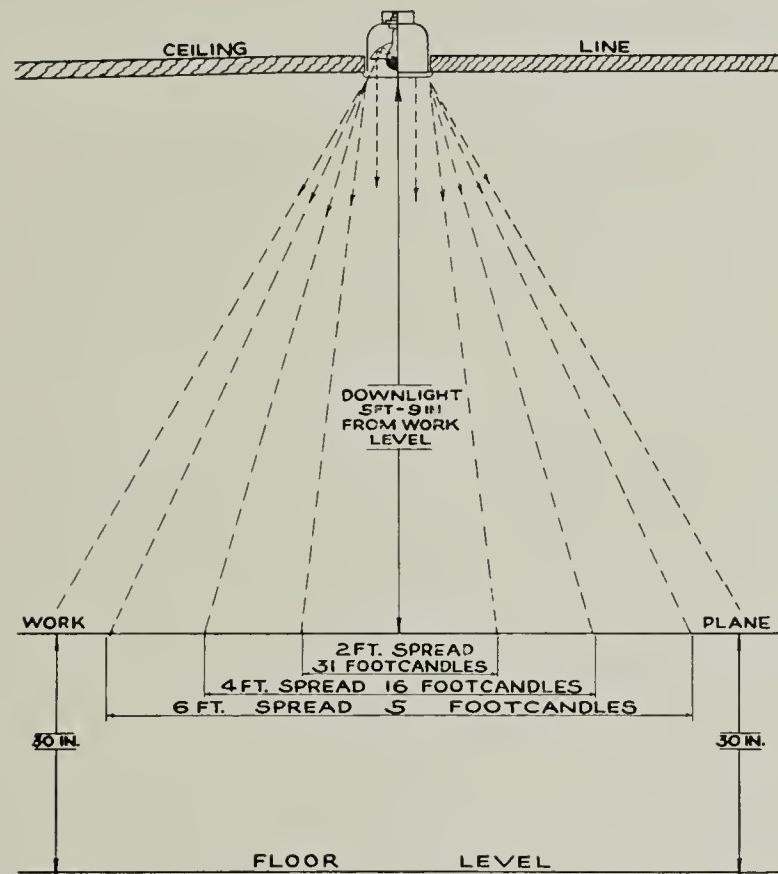
**Finish:** Silvertint.



# BUILT-IN DOWNLIGHTS

## UNDERWRITER'S APPROVED

Designed to properly control the light in a downward direction, yet diffused to prevent objectionable glare, these DOWNLITES concentrate the light in the working area.



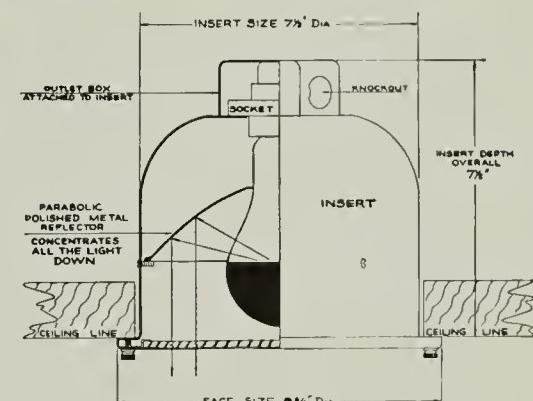
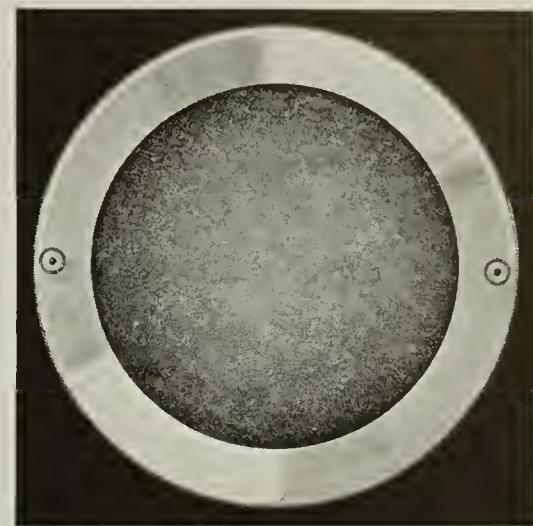
Pictorial description of footcandles delivered and distributed on work plane.

### DATA

**No. 1925**—Face size 8 $\frac{3}{4}$ " Dia.; Insert size 7 $\frac{1}{2}$ " Dia., 7 $\frac{1}{2}$ "

Deep. Furnished complete with 3 $\frac{1}{4}$ " Outlet Box attached.

**Finish:** Face polished Chromtint; Insert Housing Black—Aluminized Inside. Parabolic Reflector Polished Aluminum. Luxlite Glass Plate.



Cross section showing construction and application.

We suggest the use of a 100-Watt Bowl Silvered Lamp.



Square Soffit

### SQUARE SOFFIT

Hinged Fronts.

Front finish SATIN NICKEL.

No.	Lights	Face Size	Insert Size	Insert Depth
1504	1	8 $\frac{3}{4}$ " Sq.	7 $\frac{1}{4}$ " Sq.	5"
1505	2	10 $\frac{3}{4}$ " Sq.	9 $\frac{1}{4}$ " Sq.	5"
1506	2	12 $\frac{3}{4}$ " Sq.	11 $\frac{1}{4}$ " Sq.	5 $\frac{1}{2}$ "

### ROUND SOFFIT

Front screws on.

Front finish SATIN NICKEL.

No.	Lights	Face Size	Insert Size	Insert Depth
1501	1	9" Dia.	7 $\frac{1}{2}$ " Dia.	4"
1502	2	11" Dia.	9 $\frac{1}{2}$ " Dia.	5"
1503	2	13" Dia.	11 $\frac{1}{2}$ " Dia.	5"



Round Soffit

# SPECIAL LOCATION LIGHTING



**Cat. No. 700**—Flush Type Guarded  
**Cat. No. 115**—Surface Type Guarded

Catalog No.

115-5	Type	Surface Type Guarded—Single Face	Size Letters	5"	Overall Size	12"x6" x3"	Insert Size
115-6		Surface Type Guarded—Single Face		6"		12"x7 $\frac{3}{4}$ "x3"	
117-5		Surface Type Plain—Single Face		5"		12"x6" x3"	
117-6		Surface Type Plain—Single Face		6"		12"x7 $\frac{3}{4}$ "x3"	
700-5		Flush Type Guarded—Single Face		5"		14"x8" x3"	
700-6		Flush Type Guarded—Single Face		6"		14"x9 $\frac{3}{4}$ "x3"	
722-5		Flush Type Plain—Single Face		5"		14"x8" x3"	
722-6		Flush Type Plain—Single Face		6"		14"x9 $\frac{3}{4}$ "x3"	

Standard Finish: Black.

**Standard Glass:** Red letters on opal glass.

**Optional Glass:** White letters on red, green or black background. Green or black letters on white background.

Boxes have knockouts for  $\frac{1}{2}$ " conduit.

Flush type fronts attach with 4 screws.



**Cat. No. 722**—Flush Type Plain  
**Cat. No. 117**—Surface Type Plain

Catalog No.

115-5	Type	Surface Type Guarded—Single Face	Size Letters	5"	Overall Size	12"x6" x3"	Insert Size
115-6		Surface Type Guarded—Single Face		6"		12"x7 $\frac{3}{4}$ "x3"	
117-5		Surface Type Plain—Single Face		5"		12"x6" x3"	
117-6		Surface Type Plain—Single Face		6"		12"x7 $\frac{3}{4}$ "x3"	
700-5		Flush Type Guarded—Single Face		5"		14"x8" x3"	
700-6		Flush Type Guarded—Single Face		6"		14"x9 $\frac{3}{4}$ "x3"	
722-5		Flush Type Plain—Single Face		5"		14"x8" x3"	
722-6		Flush Type Plain—Single Face		6"		14"x9 $\frac{3}{4}$ "x3"	

Standard Finish: Black.



**No. 210**

Ceiling exit, 4" red lettering on two sides. Canopy 7 $\frac{1}{2}$ " diam. 8 $\frac{3}{4}$ " deep overall.  
**Finish:** Statuary Bronze—Pewter—Chromium.

**No. 209**

Exit bracket, 4" red lettering on two sides. Canopy 7 $\frac{1}{2}$ " diam. Extends 8 $\frac{3}{4}$ " overall.  
**Finish:** Statuary Bronze—Pewter—Chromium.

**No. 203 Bracket**

**No. 203**—2 $\frac{1}{4}$ " Fitter, 4 $\frac{1}{2}$ " white glass shade. Backplate 5 $\frac{1}{4}$ " diam. Made of 22 gauge brass.  
**Finish:** Statuary Bronze—Pewter—Chromium.



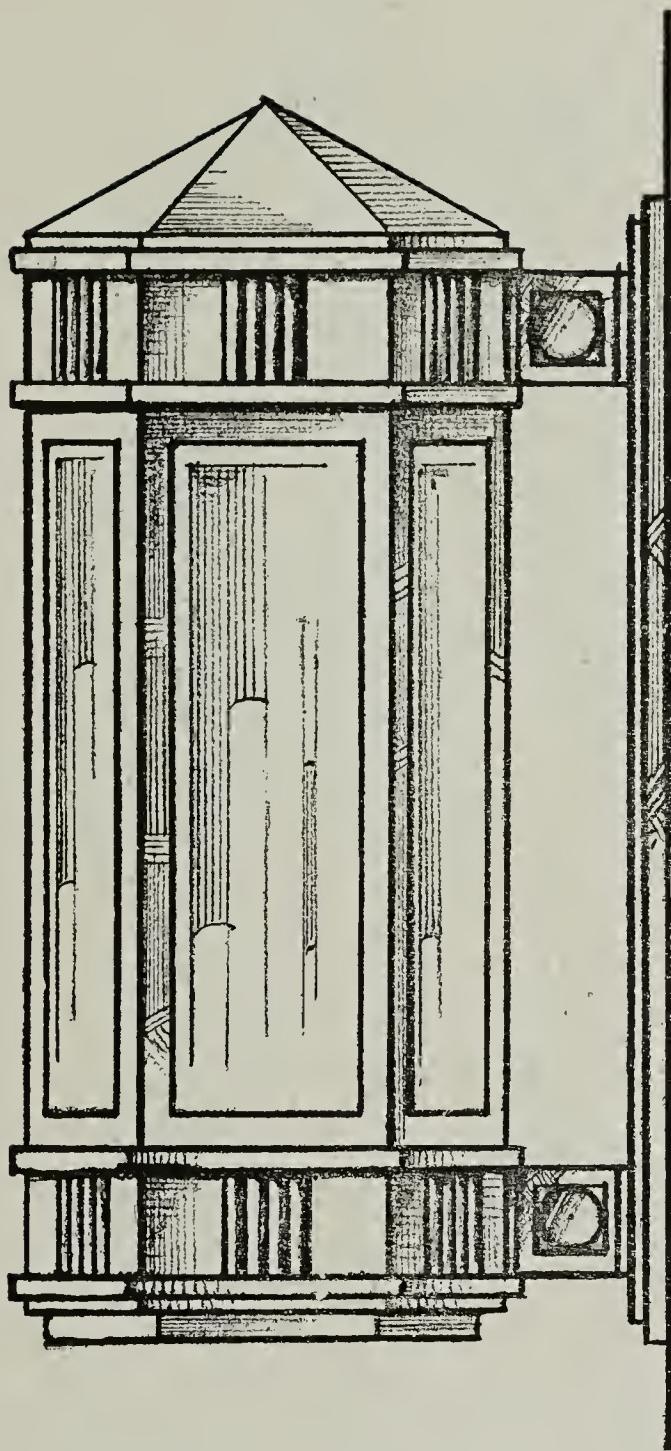
**No. 1842 Reflectolite** 10 $\frac{3}{4}$ " Dia. 6 $\frac{1}{2}$ " O.A. 150W  
**Finish:** Gray Exterior, Amlux Interior Reflecting Surface.

The Reflectolite for economical downlighting—merely screw into socket the same as you would an electric light bulb.

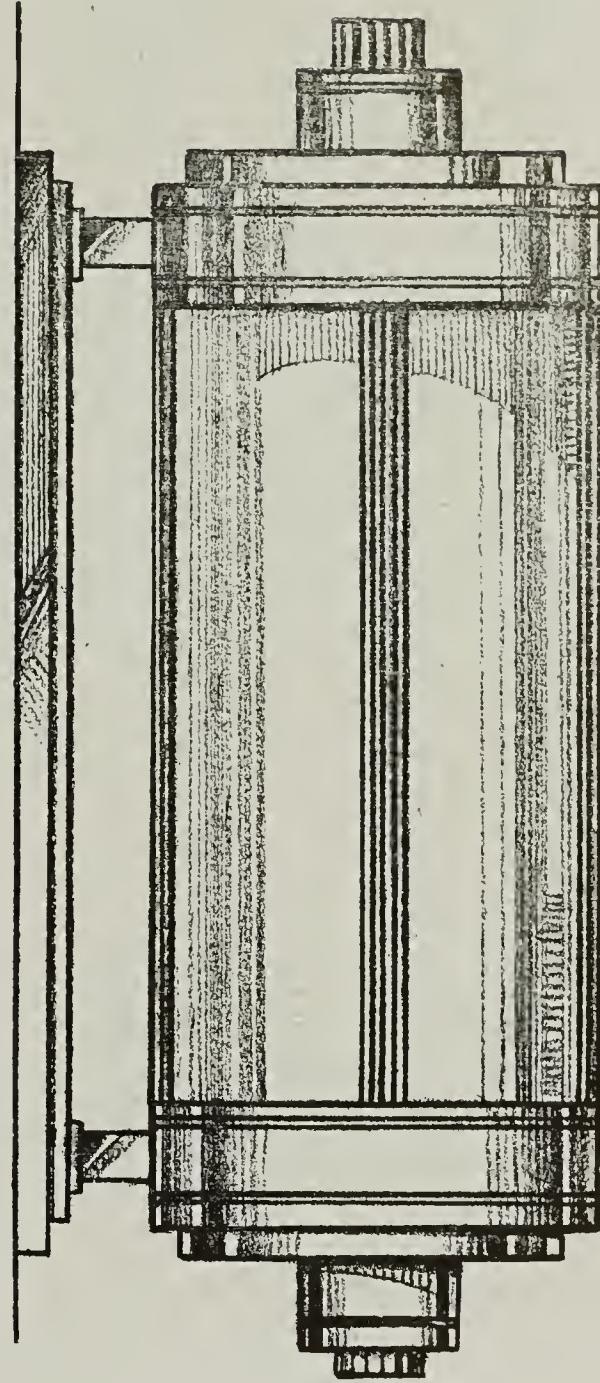


Semi-indirect luminous bowl, white Monax glass bottom plate.  
**No. 1715** 13" Dia. 12" O.A. 150W  
**Finishes:** Chromtint, Durocreme, Durocreme and Silver.

# OUTDOOR LANTERNS



No. 1870 Hexagon Bracket Lantern



No. 1874 Cylinder Bracket Lantern

Catalog No.	Lights	Body Dia.	Length O. A	Extension	Back Plate Size
1870	1-150W	9"	23½"	11"	4¼"x22"
1871	1-200W	11"	30"	12¾"	4¼"x28"

**Finish:** Standard Bronze.

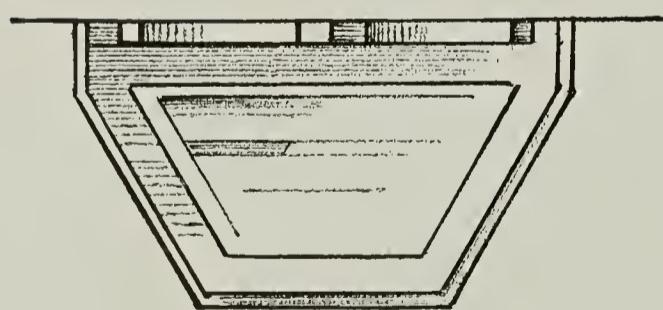
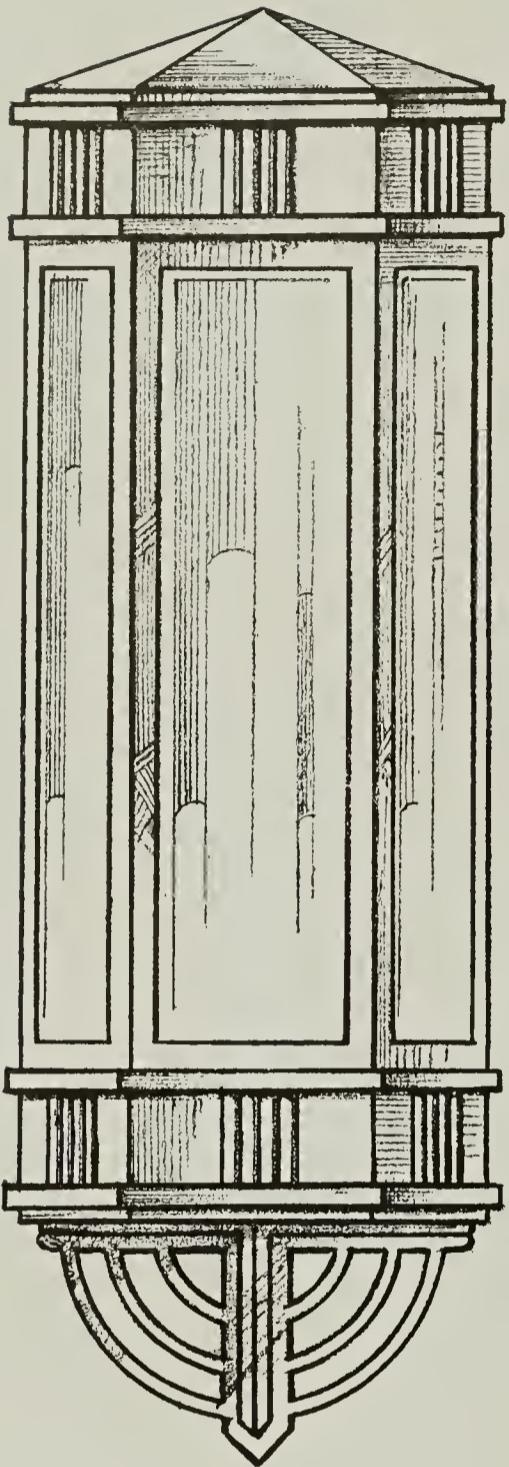
**Glass:** Flashed Opal.

Catalog No.	Lights	Glass Size	Extension	Back Plate Size
1874	1-100W	6"x16"	9"	4¼"x21"
1875	1-200W	8"x16"	11"	4¼"x21"

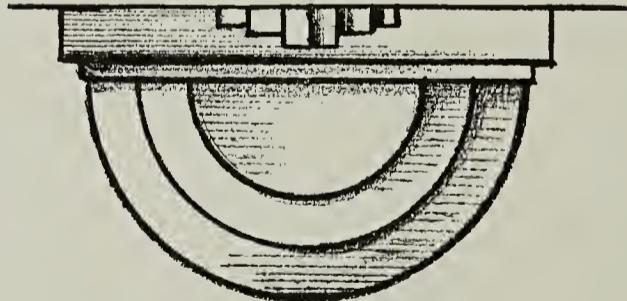
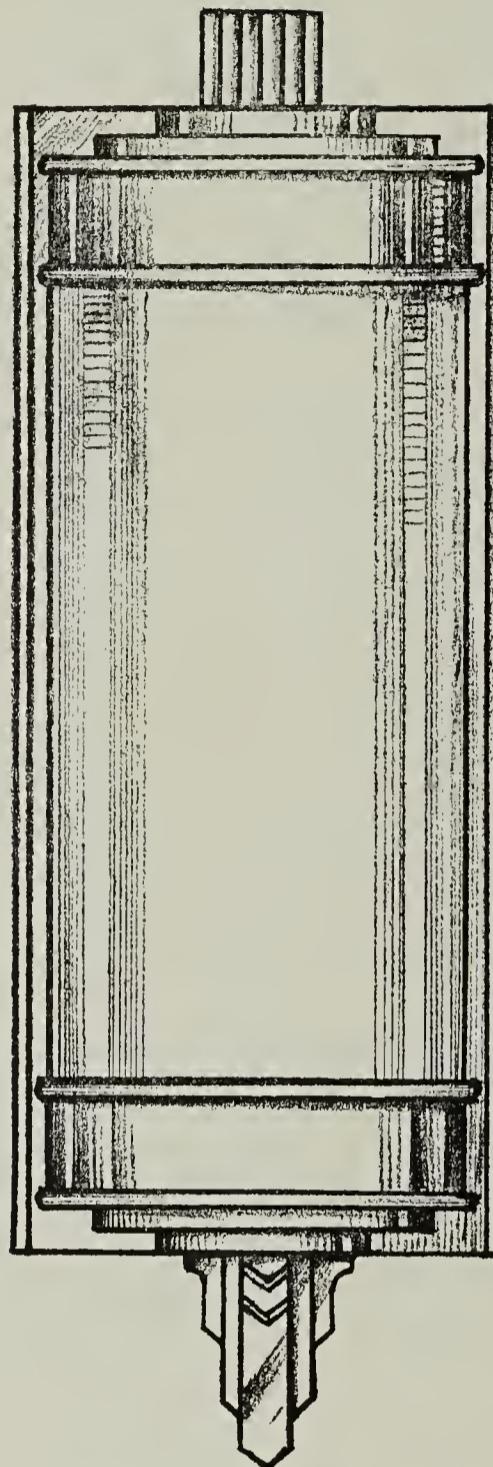
**Finish:** Standard Bronze.

**Glass:** Opal.

# OUTDOOR LANTERNS



No. 1868 Wall Pocket



No. 1872 Cylinder Pocket

Catalog No.

**1868**

**1869**

**Finish:** Standard Bronze.

**Glass:** Flashed Opal.

Lights

2-75W

3-75W

Body Dia.

10"

10"

Length O. A.

31"

38"

Extension

6"

6"

**Finish:** Standard Bronze.

**Glass:** Opal.

Catalog No.

**1872**

**1873**

Lights

2-40W

2-75W

Width

7 1/4"

9 1/4"

Length O. A.

24"

28"

Extension

6"x12" Half Cylinder

8"x16" Half Cylinder

# ADJUSTABLE FLUORESCENT WORKLITE

for Localized Lighting Complimentary to General Illumination

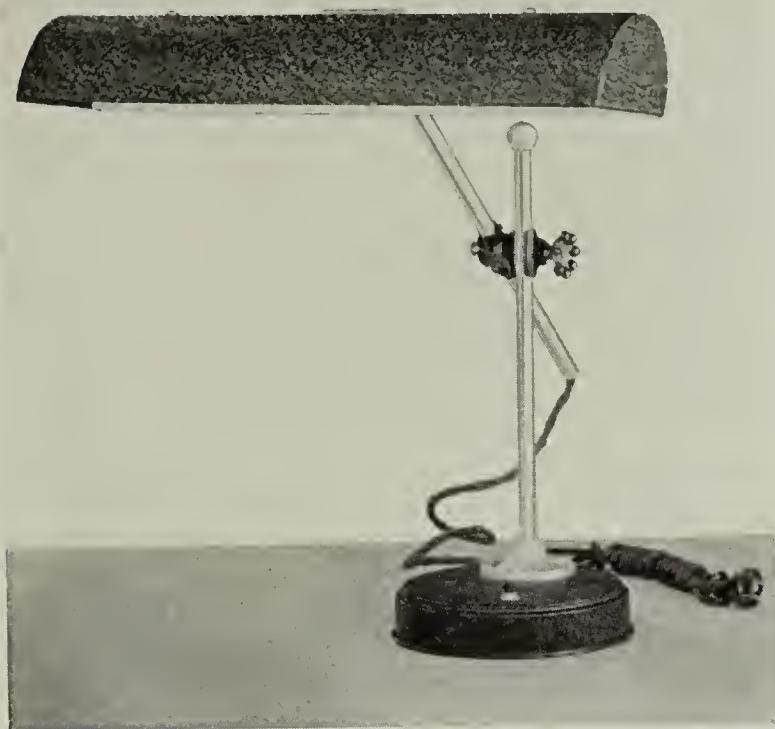
INTENSIFIES THE LIGHT WHERE

YOU WANT IT...

EASILY

CONVENIENTLY

ECONOMICALLY

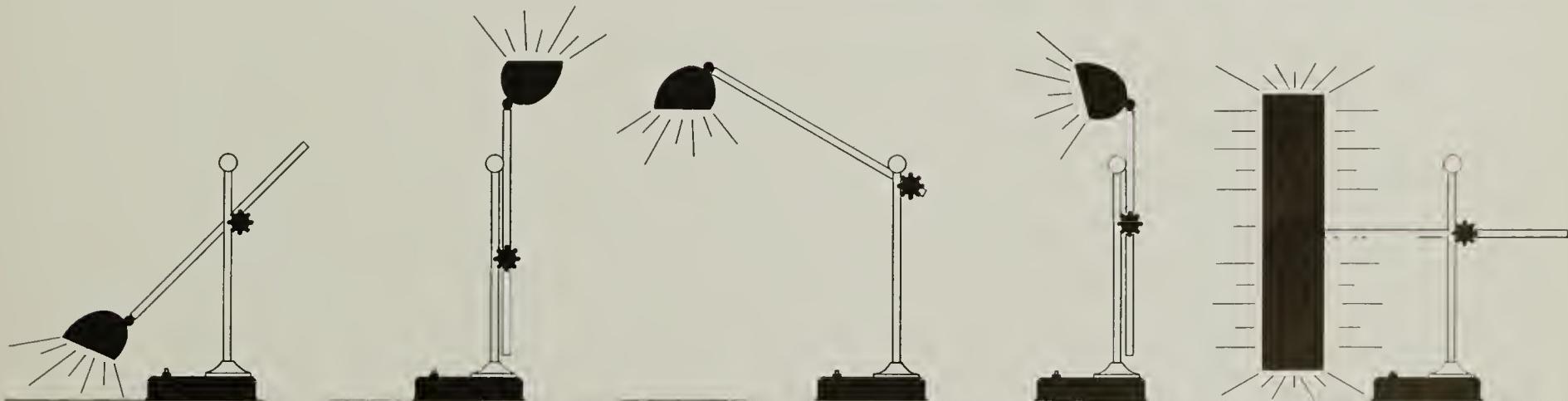


No. 1926

## Localized Lighting of Unlimited Uses and Placement

Where additional lighting is needed, with a minimum of effort, this new Worklite provides greater localized intensity as a supplement to general illumination from overhead lighting. The possibility of easy placement of the light is unlimited because of the many adjustment features.

ADJUSTABLE TO ANY POSITION, the Fluorescent Worklite makes possible lighting conditions from one unit that meet any requirement for the placement of the light for best seeing conditions and personal convenience.



## DATA

No. 1926 Complete with reactor. For AC current only (less lamp).

No. 1929 Complete with reactor. For DC current only (less lamp).

Finish: Crackle Black and Cadmium.

Height Adjustable—Extends to maximum of 20 inches—Reflector Shade 18" long.—Base: Weighted 7" diameter.—Wired complete with 7 ft. rubber cord and plug. Accommodates 15 watt Mazda T8 Fluorescent Lamp. (Lamp not furnished.)

## Characteristics of the Macbeth Lighting Glass as Manufactured by Corning Glass Works and Used Exclusively in Art Metal Equipment

**MONAX** is a single layer, homogeneous glass possessing the following outstanding characteristics:

1. Exceptionally high efficiency coupled with perfect diffusion.
2. Strength because of its single layer homogeneous characteristic.
3. Attractive lighted or unlighted appearance, always white in color.
4. Ease of maintenance, having no rough surfaces where dirt can adhere.
5. Highly resistant to atmospheric weathering thus has little depreciation.

**GALAX** is of homogeneous composition throughout. It is the one glass that is characterized by a dual opacity that permits a dense reflecting surface and a light transmitting surface to be provided at the same time. The dense reflecting surface is of such character as to efficiently reflect impinging light. The light opacity or transmitting surface properly diffuses the light to eliminate filament striations, etc., on the ceiling. There is no deterioration of reflecting efficiency caused by applied surfaces cracking or peeling because the above mentioned characteristics are inherent in the Galax glass itself.

**DENAX** is a dense, highly reflecting solid opal glass reflecting the greatest percentage of impinging light yet at the same time transmitting a small amount, both being highly diffused. Has low surface brightness. Has constant reflection factor of 83%. No deterioration. This glass lights just off white more to an ivory tone.

**HILUX** has same characteristics as DENAX from the standpoint of efficient reflection, high diffusion and low surface brightness. The material difference being that when lighted this glass has a whiter appearance than DENAX.

**WIDELITE**, optical control lens spreading the downward directed light over a large area. The prism design of this lens lowers brightness from average viewing angles. Highly efficient for light control.

**FLASHED OPAL**, a cased glass composed of two or more layers of different glasses, a clear transparent layer to which is added a layer of opal or opalescent glass. Its characteristic is excellent diffusion and uniform appearance when lighted.

## Art Metal Interior Metal Reflecting Surfaces Are Finished In Amlux Aluminum

All interior metal reflecting surfaces are obtained by a formula developed and used exclusively by The Art Metal Company. The resulting finish of the aluminum is designated as AMLUX. This AMLUX finish is a diffuse surface finish that has an exceptionally high reflection factor. It is produced by the processing of the aluminum in exclusive chemical solutions at 210 degrees Fahrenheit. This processing removes any impurities that may be in the aluminum and produces a diffuse or matte finish which is a most desirable metal reflecting surface.

AMLUX will retain its original high reflectivity if a mild soap and water is used to clean the surface whenever it may be necessary. Do not use any abrasive for this tends to destroy the reflecting surface.

All Lighting Equipment to function efficiently must have clean reflecting surfaces.

## Exterior Finishes of Silvertint or Goldtint

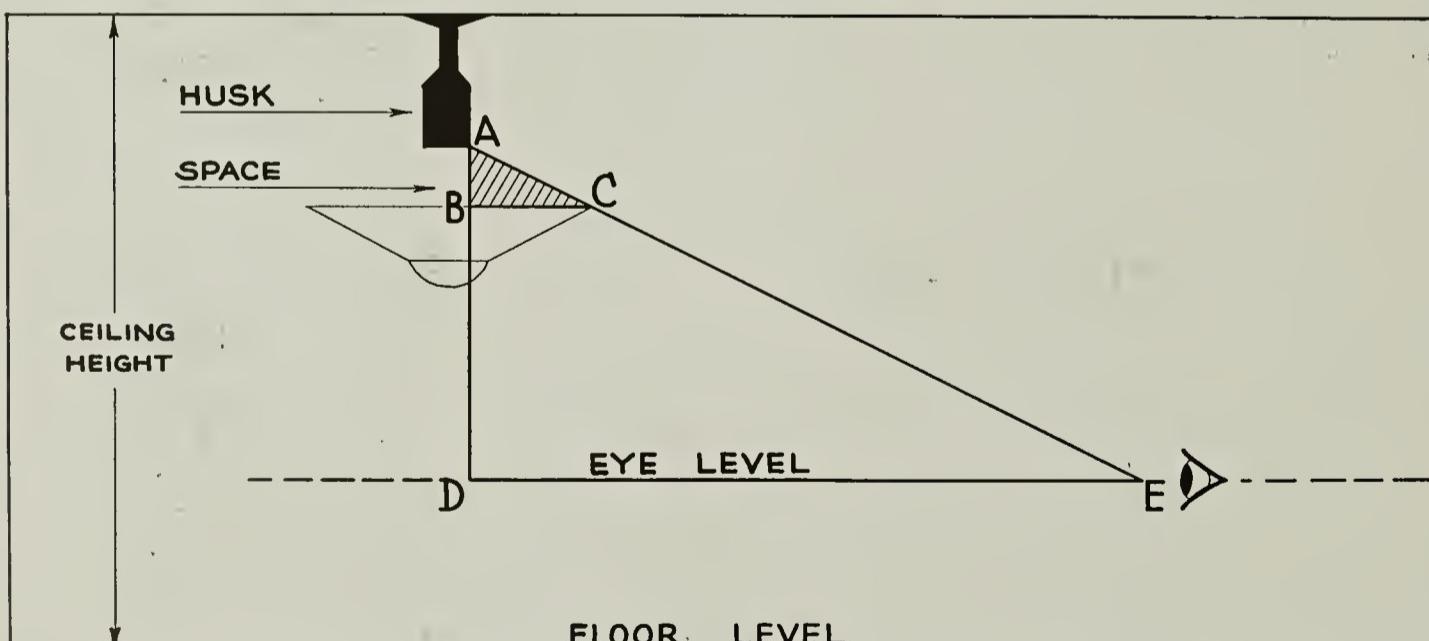
These exterior finishes, which are either standard or optional on most of the equipment, are noted for their brilliance, permanence, and harmonious blending qualities. The special processing of the aluminum surfaces to obtain the high lustre areas and the contrasting satin sheen, forms the naturally metallic finish. The surfaces are covered by the finest quality of clear lacquer for protection and permanency.

Silvertint is a finish closely resembling satin and polished silver.

Goldtint is similar to an exceptionally light bronze finish, resembling Bank Bronze in tone.

Both of these finishes were developed by Art Metal and are found only in Art Metal Lighting Equipment.

## METHOD TO COMPUTE LAMP NECK CUT OFF



A simple means for determining the maximum distance an observer can be from an installed lighting fixture before the lamp neck can be seen (if the assembled fixture has a space between the Husk and Bowl), is a matter of geometrical proportion computed as follows:

AB is to BC as AD is to X (or the distance DE). The correct arithmetical equation is as follows:

$$AB : BC = AD : X$$

$$BC \times AD$$

$$X = \frac{BC \times AD}{AB}$$

1. The distance from the husk to the bowl is AB.
2. Measure on the diameter of the bowl from the center of the bowl to the outer edge, less one-half the husk diameter is the distance BC.
3. The distance vertically from the bottom of the husk to the observer's eye level is AD.
4. The maximum distance away the observer can get before seeing the lamp is obtained by working the proportion problem. Triangle ABC is directly proportioned to ADE.
5. The figures to replace the indicated letters in the equation are determined from actual measurements of the installation.

# THE LUMEN METHOD FOR COMPUTING INTERIOR ILLUMINATION

## Foot Candles Resulting from Art Metal Fixtures Or the Lamp Size to Use In the Fixtures Are Quickly Arrived At By the Lumen Method for Computing Interior Illumination.

- Illumination values can be computed arithmetically by using correct factors in the equation. The factors given are determined from results of actual tests and furnished here for future use and reference. Those not given must be determined by the individual doing the job.

Two factors usually not known are:

(1) Size Lamp (Lamp Lumens) required per outlet for the installation.

(2). Footcandles resulting from an installation.

The equations for arriving at the above are as follows:

A. Lamp Lumens Required per Outlet =

$$\frac{\text{Footcandles} \times \text{Area in Sq. Ft. per Out.}}{\text{Coefficient of Util.} \times \text{Main. Factor.}}$$

B. Footcandles =

$$\frac{\text{Lamp Lumens} \times \text{Coef. of Util.} \times \text{Main. Factor.}}{\text{Area in Sq. Ft. per Outlet.}}$$

The following factors are necessary and appear in both equations. They will each be described in detail.

I. Area in Square feet per outlet.

II. Size Lamp, or, Lamp Lumens.

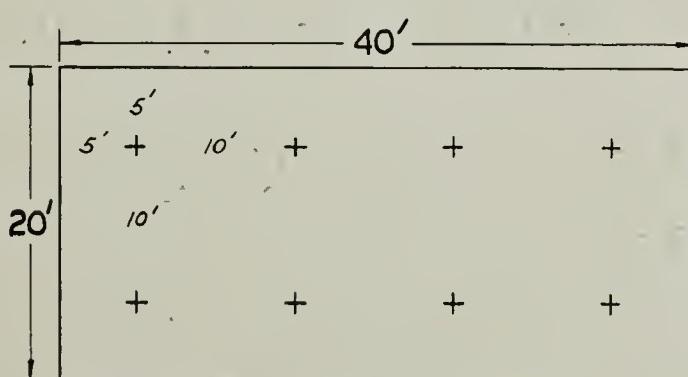
III. Coefficient of Utilization.

IV. Footcandles.

V. Maintenance Factor.

### I. Area in Square Feet Per Outlet

The arrangement or layout of outlets determines the number of outlets in a room of a given size. Dividing this number into the sq. ft. area of the room determines the area per sq. ft. of each outlet. Assume a room 20 ft. wide by 40 ft. long, with two rows of outlets on ten foot centers, thus  $20' \times 40' \div 8 = 100$  sq. ft. per outlet.



The following table is a reasonable guide for arriving quickly at spacings, areas and suspensions:

### MOUNTING HEIGHTS AND SPACINGS

Ceiling Height	Spacing	Average Area Per Outlet	Suspension*
8	7	50-60	1-1½ Ft.
9	8	60-70	1-1½ Ft.
10	9	70-85	1-2½ Ft.
11	10	85-100	1½-2½ Ft.
12	10-12	100-150	2-3 Ft.
13	10-12	100-150	2-3 Ft.
14	10-13	100-170	2½-4 Ft.
15	10-13	100-170	3-4 Ft.
16	10-13	100-170	3-4 Ft.
18	10-20	100-400	3-4 Ft.
20 & up	18-24	300-500	4-6 Ft.

\*When consulting a photometric analysis, if wide distribution is apparent revealing high candlepower in 135° to 155° zones, then 30° suspension for total and semi-indirect fixtures in rooms of 10-12-14 ft. ceiling height to a max. of 14 ft. outlet spacing, will result in reasonably good uniformity.

### II. Size Lamp or Lamp Lumens

This means the rated light output (lumen output) of the lamp and not its physical dimension. The lumen being a unit of measurement of quantity of light reveals to us that 5760 units of light are produced by a 300-watt P.S. 35 Mazda Mogul Base Lamp.

Various size lamps produce certain quantities of lumens . . . the correct lamp to produce the quantity of illumination must be determined. If only a certain size lamp can be used because of certain restrictions, then by applying its lumen output in the equation the footcandles resulting will be revealed.

### TABLE OF LAMP LUMENS

		Lumens		Lumens	
15 Watt	Mazda	I.F. — 141	300 Watt	Medium	I.F. — 5910
25 Watt	Mazda	I.F. — 260	500 Watt	Mogul	I.F. — 10050
40 Watt	Mazda	I.F. — 464	750 Watt	Mogul	I.F. — 14550
60 Watt	Mazda	I.F. — 834	1000 Watt	Mogul	I.F. — 20700
100 Watt	Mazda	I.F. — 1580	1000 Watt	Bipost	I.F. — 19600
150 Watt	Mazda	I.F. — 2610	1500 Watt	Mogul	I.F. — 32550
200 Watt	Mazda	I.F. — 3640	250 Watt	Mercury	— 7500
300 Watt	Mogul	I.F. — 5760	400 Watt	Mercury	— 16000

### III. Coefficient of Utilization

This is the percentage of light emitted by the lamp that actually gets down to and is useful on the working level. To arrive at this, certain conditions must be taken into consideration.

*Room Index:* Variations in room proportions affect the use of light. To arrive at some basic figures the General Electric Company by a concerted effort experimented with an adjustable room over a

long period of time arriving at the classifications indicated under the heading of Room Index. These have all been carefully and scientifically worked out to be used as tabulated.

*Lighting Equipment Characteristics:* Efficiency (fixture output in relation to lamp output) and distribution or control of light, are very important. The relation of these to the room proportions determines the amount of light delivered to the working plane. Coefficients of Utilization have been computed from Electrical Testing Laboratory curves of Art Metal fixtures to enable true and individual results.

*Interior Finish:* Ceilings and walls play an important part by returning to usefulness the light that is directed toward them from lighting fixtures. Our calculations have been made from ceiling reflection factors of 80-50-30 per cent, with walls of 50-30-10 per cent. This covers most conditions from very favorable to poor. Approximate reflection factors of walls and ceilings can be made effectively and easily with the little Light Meter. Place the cell of the Light Meter against the surface to be measured, draw it back slowly about two to four inches until a constant reading is obtained. Note this reading. Now turn the Meter around and place it against the surface with the cell facing away from the surface and take a second reading. Dividing the first reading by the second will give the approximate reflection factor of a diffusely reflecting surface. (Use identical lighting conditions during this test.) This procedure better qualifies a selection from the indicated tables than just a visual appraisal.

#### IV. Footcandles

In this era of advanced standards of living we have a very definitely low standard of seeing. Recommendations have been established in an effort to raise the levels of seeing illumination. We include a list of generally accepted recommendations for various seeing tasks which are offered merely as a guide of minimum values.

TABLE OF RECOMMENDED  
FOOTCANDLE VALUES

AUDITORIUMS	5	NIGHT CLUBS, BARS AND DANCE HALLS	5
AUTOMOBILE SHOW ROOMS	20	OFFICE BUILDINGS Bookkeeping, Typing and Accounting	30
BANKS		CONFERENCE ROOM General Meetings	10
Lobby	10	Corridors and Stairways	5
Offices	20	DESK WORK Intermittent Reading and Writing	20
BARBER SHOPS AND BEAUTY PARLORS	20	Studying, Designing, etc	30-50
CHURCHES		Reading Blueprints and Plans	30
Auditoriums	5	PROFESSIONAL OFFICES Waiting Room	10
Sunday School Rooms	10	Consultation Rooms	20
Pulpit or Rostrum	15	Operating Offices	20
CLUB AND LODGE ROOMS		SCHOOLS Auditoriums	10
Lounge and Reading Rooms	20-50	Classrooms, Library and Offices	20
Auditoriums	5	Corridors and Stairways	5
COURTROOMS	10	Drawing Rooms	30-50
DRAFTING ROOMS	30-50	Gymnasium (Basketball)	20
HOSPITALS		Laboratories	15
Corridors	2	Manual Training	20
Laboratories	20	Study Rooms—Desks and Blackboards	20
Lobby and Reception Room	5		
Operating Room	20		
Private Rooms and Wards	20		
HOTELS			
Lobby	10		
Dining Room	5		
Kitchen	10		
Guest Rooms	10		
Corridors	2		
Writing Rooms	20-50		
LIBRARIES			
Reading Room	20-50	STORES Light Merchandise	20
Stack Room	10	Dark Merchandise	50-100

#### V. Maintenance Factor

Inasmuch as there is no such thing as man-made permanence, any man-made object will depreciate, dirt being the enemy of efficiency. Lighting is no exception to this, especially when lack of fixture maintenance is so in evidence. In computing for Illumination values this depreciation of lamps, fixtures, reflecting surfaces, etc., must be allowed for so that desired footcandle levels may be maintained in service as contrasted to initial values. The illumination, maintained in service under average conditions, will be about 70% of the initial value or .70 when expressed as a maintenance factor. If conditions are above average this value may be higher, or conditions may be the reverse making this value lower. Consideration has been given these conditions in the following tabulations.

#### PROCEDURE FOR COMPUTING ILLUMINATION VALUES

The essential parts of the equation have been briefly discussed with enough informative data to allow for an understanding of the factors of the equation. To illustrate the use of this follow the working of a typical example.

"The room to be lighted is a school classroom, 20 ft. wide, 40 ft. long. Two rows of fixtures on 10 ft. centers. The ceiling is 12 ft. high. Ceiling paint, flat white good clean condition . . . sidewalls, light buff good clean condition. 25 footcandles are required. What size lamps per outlet are needed to do the job? The Plasticlite No. 1860 has been selected as the type unit."

The equation for this problem—

Lamp Lumens =

Footcandles × Area in Sq. Ft. per Outlet.

Coefficient of Utilization × Maintenance Factor.

Step No. 1—Footcandles have been determined at 25. Area in Sq. Ft. per Outlet = 800 Sq. Ft. ÷ 8 Outlets or 100 Sq. Ft. per Outlet.

Step No. 2—Coefficient of Utilization. From room index table refer to column under 12 ft. ceiling height in semi-indirect band, move down to 20 ft. room width space and in the row indicated by heavy type for 30 to 42 ft. room length, find letter "E". Now refer to next table calculated specifically for the 1860 Plasticlite fixture. Under room index find E, having determined paint conditions as very favorable using the 80% ceiling reflection factor and 50% wall reflection factor, move down this column to E and find .39—this is the Coefficient of Utilization.

Step No. 3—Maintenance Factor . . . Average determined for this particular fixture is .65.

Step No. 4—Equation now stands ready for computing viz.:

Lamp Lumens (?) =

Footcandles (25) × Area in Sq. Ft. per Outlet (100)

Coef. of Util. (.39) × Main. Fac. (.65)

$$= \frac{2500}{.2535} = 9861 \text{ lumens.}$$

A 500-watt I.F. general service P.S. 40 lamp has output of 10,050 lumens and therefore would be recommended.

Using the same identical problem with a slight change the other equation can be used viz.:

"The room to be lighted is a school classroom, 20 ft. wide, 40 ft. long. Two rows of fixtures on 10 ft. centers. The ceiling is 12 ft. high. Ceiling paint, flat white good

clean condition . . . side walls, light buff good clean condition. The Plasticlite No. 1860 has been selected as the type unit and 500-watt lamps per unit are to be used. What will be the resulting footcandles?"

The equation for this problem—

Footcandles (?) =

$$\frac{\text{Lamp Lumens} \times \text{Coef. of Util.} \times \text{Main. Fac.}}{\text{Area Sq. Ft. per Lamp}}$$

Fill in the equation exactly as before, however, knowing that 500-watt lamps are to be used, refer to Table of Lamp Lumens which specifies Lumen output for 500-watt lamp—thus the equation ready for computing is:

$$\frac{\text{Footcandles} = 10,050 \times .39 \times .65}{100} = \frac{2548 \text{ or } 25 \text{ F.C.}}{100}$$

**TABLE OF ROOM INDEX**  
(Classification of rooms according to their proportions)

CEILING HEIGHT—FEET												
For Semi-Indirect and Indirect Lighting		9 and 9½	10 to 11½	12 to 13½	14 to 16½	17 to 20	21 to 24	25 to 30	31 to 36	37 to 50		
<b>MOUNTING HEIGHT ABOVE FLOOR—FEET</b>												
For Direct and Semi-Direct Lighting		7 and 7½	8 and 8½	9 and 9½	10 to 11½	12 to 13½	14 to 16½	17 to 20	21 to 24	25 to 30	31 to 36	37 to 50
Room Width (Feet)	Room Length (Feet)	ROOM INDEX										
9 (8½-9)	8-10	H	I	J	J							
	10-14	H	I	I	J	J						
	14-20	G	II	I	J	J	J					
	20-30	G	G	II	I	J	J	J				
	30-42	F	G	II	I	J	J	J				
10 (9½-10½)	42-up	E	F	G	H	I	J	J				
	10-14	G	H	I	J	J						
	14-20	G	H	I	J	J	J					
	20-30	F	G	H	I	J	J	J				
	30-42	F	G	II	I	J	J	J				
	42-60	E	F	G	H	I	J	J				
12 (11-12½)	60-up	E	F	F	II	I	J	J				
	10-14	G	H	I	I	J	J					
	14-20	F	G	H	I	J	J	J				
	20-30	F	G	G	H	I	J	J				
	30-42	E	F	G	H	I	J	J				
	42-60	E	F	F	G	I	J	J				
14 (13-15½)	60-up	E	E	F	G	H	I	J				
	14-20	F	G	H	I	J	J	J				
	20-30	E	F	G	H	I	J	J				
	30-42	E	F	G	H	I	J	J				
	42-60	E	F	G	H	I	J	J				
	60-90	D	E	F	G	H	I	J	J	J	J	
17 (16-18½)	90-up	D	E	E	F	G	I	J	J	J	J	
	14-20	E	F	G	H	I	J	J	J	J	J	
	20-30	E	F	G	H	I	J	J	J	J	J	
	30-42	D	E	F	G	H	I	J	J	J	J	
	42-60	D	E	E	F	G	I	J	J	J	J	
	60-110	D	E	E	F	G	I	J	J	J	J	
20 (19-21½)	110-up	C	D	E	F	G	H	I	J	J	J	
	20-30	D	E	F	G	H	I	J	J	J	J	
	30-42	D	E	F	G	H	I	J	J	J	J	
	42-60	D	D	E	F	G	I	J	J	J	J	
	60-90	C	D	E	F	G	I	J	J	J	J	
	90-140	C	D	D	E	F	I	J	J	J	J	
24 (22-26)	140-up	C	C	D	E	F	G	H	I	J	J	
	20-30	D	E	E	F	G	H	I	J	J	J	
	30-42	C	D	D	E	F	G	H	I	J	J	
	42-60	C	D	D	E	F	G	H	I	J	J	
	60-90	C	D	D	E	F	G	H	I	J	J	
	90-140	C	D	D	E	F	G	H	I	J	J	
30 (27-33)	140-up	C	C	D	E	F	G	H	I	J	J	
	30-42	C	D	D	E	F	G	H	I	J	J	
	42-60	C	D	D	E	F	G	H	I	J	J	
	60-90	B	C	C	D	E	F	G	H	I	J	
	90-140	B	C	C	D	E	F	G	H	I	J	
	140-180	B	C	C	D	E	F	G	H	I	J	
36 (34-39)	180-up	B	C	C	D	E	F	G	H	I	J	
	30-42	B	C	D	E	F	G	H	I	J	J	
	42-60	B	C	D	E	F	G	H	I	J	J	
	60-90	A	C	C	D	E	F	G	H	I	J	
	90-140	A	B	C	C	D	E	F	G	H	J	
	140-200	A	B	C	C	D	E	F	G	H	J	
42 (40-45)	200-up	A	B	C	C	D	E	F	G	H	I	
	42-60	A	B	C	C	D	E	F	G	H	I	
	60-90	A	B	C	C	D	E	F	G	H	I	
	90-140	A	B	C	C	D	E	F	G	H	I	
	140-200	A	B	C	C	D	E	F	G	H	I	
50 (46-55)	200-up	A	A	A	C	C	D	E	F	G	H	
	42-60	A	A	B	C	D	E	F	G	H	I	
	60-90	A	A	B	C	D	E	F	G	H	I	
	90-140	A	A	A	C	C	D	E	F	G	H	
	140-200	A	A	A	C	C	D	E	F	G	H	
60 (56-67)	200-up	A	A	A	B	C	D	E	F	G	H	
	60-90	A	A	A	B	C	D	E	F	G	I	
	90-140	A	A	A	B	C	D	E	F	G	H	
	140-200	A	A	A	B	C	D	E	F	G	H	
75 (68-90)	200-up	A	A	A	A	B	C	D	E	F	G	
	60-90	A	A	A	A	B	C	D	E	F	I	
	90-140	A	A	A	A	B	C	D	E	F	H	
90 or more	140-200	A	A	A	A	B	C	D	E	F	G	
	200-up	A	A	A	A	B	C	D	E	F	G	

**TABLE OF COEFFICIENTS OF UTILIZATION** (Computed from Electrical Testing Laboratory curves of Art Metal equipment.)

Type of Light Distribution.	Art Metal Standard Listed Catalog Lighting Equipment	Ceiling	80%				50%				30%				Maintenance Factors	SUGGESTED USES
			Walls		50%	30%	10%	50%	30%	10%	50%	30%	10%	50%		
			COEFFICIENTS OF UTILIZATION													
	No. 1860		J .18	.14	.12	.12	.10	.08	.06	.05						SCHOOL CLASSROOMS GENERAL OFFICES GENERAL STORES (SMALL)
	No. 1782S		I .23	.19	.16	.16	.13	.11	.09	.08						.75 Clean .65 AV. .60 Dirty
	No. 1830S		H .27	.22	.20	.18	.15	.13	.10	.09						
	No. 1732S		G .31	.26	.22	.21	.18	.16	.12	.11						
	No. 1863		F .33	.28	.25	.23	.20	.18	.13	.12						
	No. 1915		E .39	.33	.30	.26	.22	.20	.15	.14						
	No. 1758S		D .42	.37	.33	.28	.25	.23	.17	.16						
	No. 1787S		C .45	.40	.37	.30	.27	.25	.18	.17						
	No. 1780S		B .49	.45	.42	.32	.30	.28	.20	.19						
	No. 1733S		A .51	.48	.41	.35	.32	.30	.22	.20						
	No. 1759S		J .16	.12	.10	.10	.08	.07	.05	.04						
			I .20	.16	.14	.13	.11	.09	.06	.05						
			H .23	.19	.17	.15	.12	.11	.08	.06						
			G .27	.23	.19	.18	.15	.13	.09	.08						
			F .30	.25	.22	.19	.16	.14	.10	.09						
			E .34	.29	.26	.22	.19	.17	.11	.10						
			D .37	.33	.29	.23	.21	.19	.13	.12						
			C .40	.36	.32	.25	.23	.21	.14	.13						
			B .44	.40	.37	.27	.26	.24	.16	.15						
			A .46	.43	.39	.30	.27	.26	.17	.16						
			J .17	.13	.11	.12	.10	.08	.07	.06						
			I .22	.18	.15	.15	.13	.11	.09	.08						
			H .25	.21	.19	.17	.14	.13	.11	.09						
			G .28	.24	.21	.20	.17	.15	.12	.11						
			F .30	.26	.23	.22	.19	.17	.13	.12						
			E .35	.31	.28	.24	.21	.20	.15	.14						
			D .38	.34	.31	.26	.21	.22	.17	.16						
			C .40	.36	.33	.27	.25	.24	.18	.17						
			B .41	.41	.38	.30	.28	.26	.19	.18						
			A .46	.43	.40	.32	.29	.28	.21	.19						
			J .15	.12	.10	.10	.08	.07	.05	.04						
			I .20	.16	.14	.14	.11	.10	.07	.06						
			H .23	.19	.17	.15	.12	.11	.08	.07						
			G .27	.21	.19	.18	.15	.13	.09	.08						
			F .29	.24	.21	.19	.16	.15	.10	.09						
			E .33	.29	.26	.22	.19	.17	.12	.11						
			D .36	.32	.29	.23	.21	.20	.17	.16						
			C .38	.35	.32	.25	.22	.21	.14	.13						
			B .42	.39	.36	.27	.25	.24	.16	.15						
			A .44	.41	.38	.30	.27	.26	.18	.17						
			J .15	.11	.10	.10	.09	.07	.05	.04						
			I .20	.16	.14	.14	.11	.10	.07	.06						
			H .23	.19	.17	.15	.13	.11	.09	.07						
			G .26	.22	.19	.18	.15	.14	.10	.09						
			F .29	.24	.20	.20	.17	.15	.11	.10						
			E .33	.29	.26	.22	.19	.17	.13	.12						
			D .36	.32	.29	.21	.21	.20	.14	.13						
			C .38	.31	.31	.25	.23	.21	.15	.14						
			B .42	.39	.36	.27	.26	.21	.17	.16						
			A .44	.41	.38	.30	.27	.26	.18	.17						
			J .15	.11	.10	.10	.09	.08	.07	.06						
			I .20	.16	.14	.14	.11	.10	.07	.06						
			H .23	.19	.17	.15	.13	.11	.09	.07						
			G .26	.22	.19	.18	.15	.13	.10	.09						
			F .29	.24	.21	.20	.17	.15	.11	.10						
			E .33	.29	.26	.22	.19	.17	.13	.12						
			D .36	.32	.29	.23	.21	.20	.14	.13						
			C .38	.31	.31	.25	.23	.21	.15	.14						
			B .42	.39	.36	.27	.26	.21	.17	.16						
			A .44	.41	.38	.30	.27	.26	.18	.17						
			J .17	.13	.11	.12	.10	.08	.07	.06						
			I .22	.18	.16	.15	.13	.11	.09	.08						
			H .25	.21	.19	.17	.15	.13	.11	.09						
			G .28	.24	.21	.20	.17	.15	.12	.11						
			F .31	.26	.23	.21	.18	.17	.13	.12						
			E .35	.31	.28	.24	.21	.19	.15	.14						
			D .38	.34	.26	.26	.23	.22	.16	.15						
			C .42	.37	.31	.27	.25	.23	.17	.16						
			B .44	.41	.38	.29	.28	.26	.19	.18						
			A .46	.43	.41	.32	.29	.28	.20	.19						
			J .17	.13	.11	.12	.10	.08	.07	.06						
			I .22	.18	.16	.15	.13	.11	.09	.08						
			H .25	.21	.19	.17	.15	.13	.11	.09						
			G .28	.24	.21	.20	.17	.15	.							

**TABLE OF COEFFICIENTS OF UTILIZATION** (Computed from Electrical Testing Laboratory curves of Art Metal equipment.)

Type of Light Distribution	Art Metal Standard Listed Catalog Lighting Equipment	Ceiling	80%		50%		30%		Maintenance Factors	SUGGESTED USES
			Walls		50%	30%	10%	50%		
			Room Index	COEFFICIENTS OF UTILIZATION						
	No. 1930		J .22	.17	.15	.17	.14	.12	.11	.10
			I .28	.23	.21	.21	.18	.16	.15	.13
			H .31	.27	.25	.24	.21	.19	.17	.15
			G .35	.31	.27	.27	.24	.22	.19	.18
			F .38	.33	.30	.29	.26	.24	.20	.19
			E .43	.38	.35	.32	.29	.27	.23	.22
			D .46	.42	.39	.35	.32	.30	.25	.24
			C .49	.45	.42	.36	.34	.32	.26	.25
			B .53	.49	.46	.39	.37	.35	.29	.27
			A .55	.52	.49	.41	.39	.37	.30	.29
	No. 1944		J .20	.15	.13	.15	.12	.10	.09	.07
			I .26	.21	.18	.19	.16	.14	.12	.10
			H .29	.25	.22	.21	.18	.16	.14	.12
			G .34	.29	.25	.25	.21	.19	.16	.14
			F .36	.31	.28	.27	.23	.21	.17	.16
			E .41	.36	.33	.30	.26	.24	.20	.18
			D .45	.40	.36	.32	.29	.27	.22	.21
			C .48	.43	.40	.34	.31	.29	.23	.22
			B .52	.48	.45	.37	.35	.33	.25	.24
			A .54	.51	.47	.39	.36	.35	.27	.25
	No. 1943		J .21	.16	.14	.16	.13	.11	.10	.08
			I .27	.22	.19	.21	.17	.15	.13	.12
			H .31	.26	.23	.23	.20	.17	.16	.14
			G .35	.30	.26	.26	.23	.20	.17	.16
			F .38	.33	.29	.29	.25	.22	.19	.17
			E .43	.38	.34	.32	.28	.26	.22	.20
			D .47	.42	.38	.34	.31	.29	.24	.23
			C .50	.45	.41	.36	.33	.31	.26	.24
			B .54	.50	.47	.39	.37	.35	.28	.27
			A .57	.53	.49	.42	.39	.37	.30	.28
	No. 1946		J .19	.14	.12	.15	.12	.10	.10	.08
			I .24	.20	.17	.20	.16	.14	.14	.12
			H .27	.23	.20	.22	.19	.17	.16	.14
			G .30	.23	.23	.25	.21	.19	.18	.16
			F .33	.26	.25	.27	.23	.21	.19	.18
			E .37	.29	.30	.30	.26	.24	.22	.21
			D .40	.36	.33	.32	.29	.27	.25	.23
			C .43	.39	.35	.34	.31	.29	.26	.25
			B .46	.43	.40	.37	.34	.32	.28	.27
			A .48	.45	.42	.39	.36	.34	.30	.28
	No. 1947		J .14	.11	.09	.09	.07	.06	.04	.03
			I .19	.15	.13	.12	.09	.08	.05	.04
			H .22	.18	.16	.13	.11	.09	.07	.05
			G .25	.20	.18	.16	.13	.12	.07	.07
			F .27	.23	.20	.17	.15	.13	.08	.07
			E .32	.27	.24	.20	.17	.15	.10	.09
			D .35	.30	.27	.21	.19	.17	.11	.10
			C .37	.33	.30	.23	.20	.19	.12	.11
			B .40	.37	.35	.25	.23	.22	.13	.13
			A .42	.40	.37	.27	.25	.23	.15	.13
	No. 1819		J .18	.14	.12	.12	.10	.08	.06	.05
			I .23	.19	.16	.15	.13	.11	.08	.07
			H .26	.22	.20	.17	.14	.13	.10	.08
			G .31	.26	.22	.20	.17	.15	.11	.10
			F .33	.28	.25	.22	.19	.17	.12	.11
			E .38	.33	.30	.25	.21	.20	.14	.13
			D .41	.37	.33	.27	.24	.22	.16	.15
			C .44	.40	.36	.28	.26	.24	.16	.16
			B .48	.45	.41	.31	.29	.27	.18	.17
			A .51	.47	.44	.33	.31	.29	.20	.18
	No. 1948		J .15	.12	.10	.11	.09	.07	.06	.05
			I .19	.16	.14	.14	.11	.10	.08	.07
			H .22	.19	.17	.15	.13	.12	.10	.08
			G .25	.21	.19	.18	.15	.14	.11	.10
			F .27	.23	.21	.19	.17	.15	.12	.11
			E .31	.27	.24	.21	.19	.17	.13	.13
			D .33	.30	.27	.23	.21	.20	.15	.14
			C .35	.32	.30	.24	.22	.21	.16	.15
			B .38	.36	.33	.26	.25	.23	.17	.16
			A .40	.38	.35	.28	.26	.25	.18	.17
	No. 6251		J .16	.13	.11	.12	.09	.08	.06	.05
			I .21	.17	.15	.15	.12	.11	.09	.08
			H .24	.20	.18	.17	.14	.13	.11	.09
			G .28	.23	.20	.20	.17	.15	.12	.10
			F .30	.26	.23	.21	.18	.16	.13	.12
			E .34	.30	.27	.24	.21	.19	.15	.14
			D .37	.33	.30	.26	.23	.22	.17	.16
			C .40	.36	.33	.27	.25	.23	.18	.16
			B .43	.40	.37	.30	.28	.26	.19	.18
			A .45	.42	.39	.32	.29	.28	.21	.19
	No. 1949		J .16	.12	.10	.11	.09	.07	.06	.05
			I .20	.16	.14	.14	.11	.10	.08	.07
			H .23	.19	.17	.15	.13	.12	.09	.08
			G .26	.22	.19	.18	.15	.14	.10	.10
			F .29	.24	.22	.20	.17	.15	.11	.11
			E .33	.29	.26	.22	.19	.18	.13	.12
			D .34	.32	.29	.24	.22	.20	.15	.14
			C .38	.34	.31	.25	.23	.22	.16	.14
			B .41	.38	.35	.27	.26	.24	.17	.16
			A .43	.40	.38	.29	.27	.26	.19	.17

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**THE ART METAL COMPANY, CLEVELAND, OHIO**



